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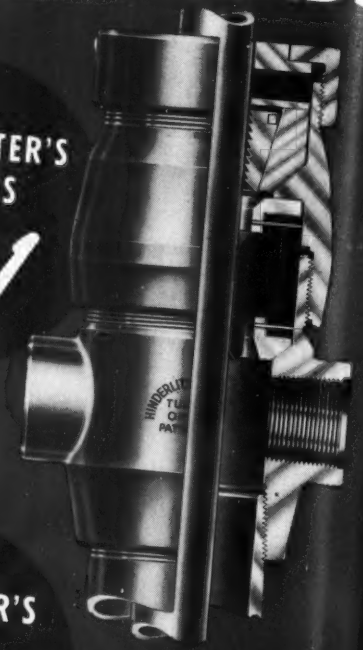

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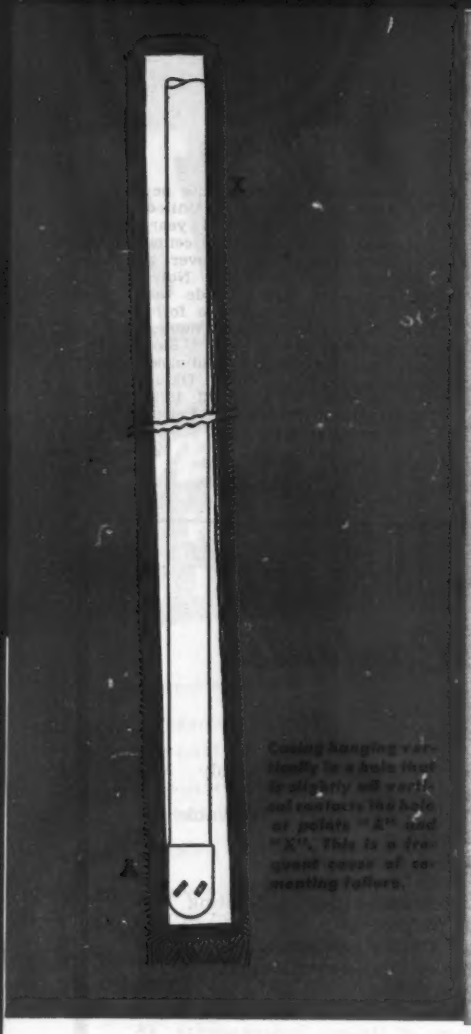

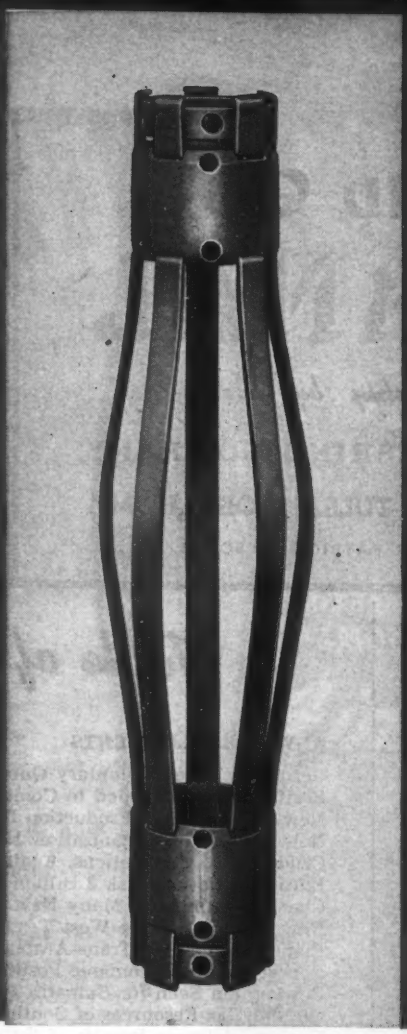

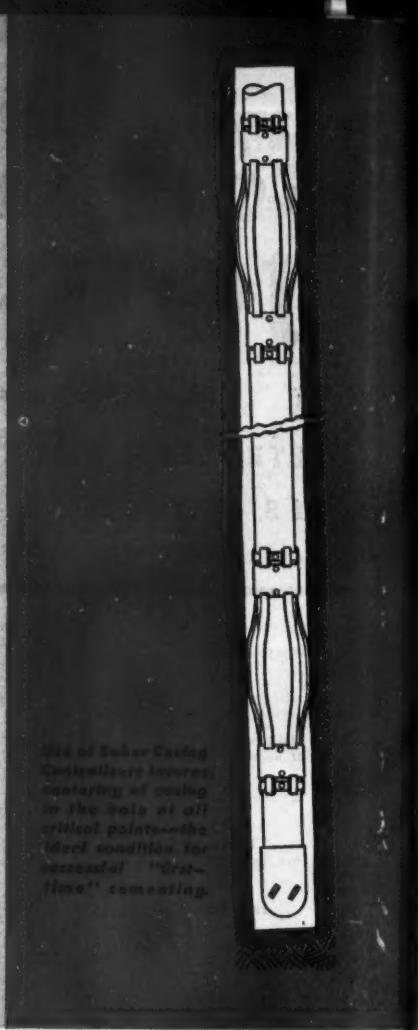

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An Intermediate Market

THE 1947 season of maximum gasoline consumption has ended and the well-grounded fears of several months ago regarding summer shortages have not materialized. The reason is readily apparent from an examination of the weekly chart of this issue showing crude runs to stills.

Fully appreciating the enlarged requirements ahead, refiners this year started their operations at higher levels than in 1946. After expanding their runs to 5 million barrels daily in March, strikes reduced operating levels, resulting in permanent output losses for the entire year. But the 5-million figure was again reached in late May and over the past month has passed 5,200,000 bbl. daily.

Only refinery operators know the difficulties encountered in arriving at these record runs. Many shifts in the movement of crude oil were necessary in order to assure the maximum utilization of transportation facilities. Obsolete processing units were rehabilitated where possible and placed on stream. Some companies absorbed the high costs of crude-oil transportation by rail in order to operate their plants at capacity.

Not generally realized is the fact that these record runs were not brought about primarily by gasoline demands. If enlarged motor-fuel requirements had been the only problem confronting refiners in recent months the solution would not have been difficult.

A few comparative figures will serve to explain this situation. The June gasoline output of United States refiners, according to the latest Bureau of Mines report, was 23 per cent greater than in June 1941. But for the same periods the increase in kerosine production was 67 per cent and distillate 65 per cent. Thus the percentage growth in demand for kerosine, diesel fuel, furnace oil, gas oil, and other intermediate products since prewar days has been nearly three times that of gasoline.

What this has meant in refinery operations is revealed in a comparison of yields. The gasoline and naphtha yield of refineries in 1941 was 44.2 per cent but only 40.2 per cent in June this year. Comparing all of 1941 with June this year shows that kerosine yields have increased from 5.2 to 5.7 per cent and distillate 13.4 to 15.8 per cent.

Refiners as a group could more than have taken care of this year's increase in motor-fuel requirements by a return to prewar yields. Such a program was not possible because of the demands for the products largely consumed as fuel selling at prices under those prevailing for gasoline. So today's markets are not dominated either by a lack of facilities or raw material to refine gasoline, but rather by demands for intermediate oil as fuel. A general appreciation of that fact will be helpful in solving current and future problems.

Nation's Refineries Get Voluntary Quotas for Government Supply

WASHINGTON.—Voluntary quotas of sales of petroleum products to the federal Government were assigned all large refineries in the country this week in letters sent by the Oil and Gas Division over the signature of Secretary of the Interior Krug.

Every refinery of 10,000 bbl. per day or more, plus some others particularly well situated to supply government orders, was assigned a "minimum tender" for the balance of 1947 and for the first half of 1948. The companies are not required to furnish these amounts to the Government, but are strongly urged to meet the schedule.

The quotas were set by OGD by totaling the estimated requirements of all government agencies for principal petroleum products and dividing this among the larger refineries, with many individual adjustments for geographical location and ability to produce the types of products needed by the Government.

Each refiner was given a figure for total barrels of all principal products, with no breakdown as to types of products or government procurement agency, but with an indication of preference for delivery on (1) the West Coast, (2) inland, or (3) the East Coast, Gulf, or Caribbean. It was felt that if each refiner filled government orders approximating the requested total, the Government's supplies would about balance out as between the various types of products needed. Individual quotas given each refiner will not be made public.

Justice Department Approved Plan

The voluntary quota plan was decided upon at the time Secretary Krug asked the larger refiners to include government needs in their programing for the coming winter operations, and the tenders now assigned each company are intended to assist in this programing rather than being the result of reports to the Government of readiness to supply any particular amounts.

The quota plan has been approved by the Department of Justice in a letter to Krug from John F. Sonnett, assistant attorney general, who wrote:

"This department would not contemplate instituting action under the antitrust laws against a supplier of petroleum products solely because of individual action taken by such supplier to make tenders of his products as requested in your letter."

In explaining the plan Krug said in his letter to the attorney general:

"This department and the military procurement agencies have found that there is a critical gap between government requirements and coverage which among other things imperils the national security. It is the opinion of this department that government requirements will not be met unless the various oil companies set aside products for meeting those requirements.

"We have therefore decided that a direct appeal to each company and individual in the petroleum industry is necessary, whether such individual or company is normally a supplier of the Government or not. With the concurrence of representatives of the Army-Navy Petroleum Board and the Bureau of Federal Supply, we propose to send separately to various firms in the petroleum industry an individual letter which will advise each of our determination of the minimum tenders which the recipient should make to the Government. A draft of the proposed letter, which in each case will be identical save for the tabulation, is enclosed. By a simultaneous release to the trade press, it will be made clear that the Government will welcome tenders from companies or individuals not receiving an individual letter."

The form letter from Krug to each refiner states:

"Members of the oil industry have assured us on numerous occasions that the Government's petroleum requirements would be fully and promptly met. We have been gratified with these assurances, but minimum essential government requirements have not been fully met and an emergency will develop unless they are met.

"We are therefore calling on each refiner and distributor of petroleum products to make the fullest possible tender to the Government, regardless of his individual capacity or the location of his refineries or sources of supply. . . . The Government welcomes tenders of petroleum products from any source whatsoever, including individuals and enterprises to whom no letter such as this is being sent."

Several Prominent Companies Involved In Persistent Merger Reports

PERSISTENT rumors in financial circles of the past several weeks which lack confirmation from any of the companies or individuals concerned involve the sale of the controlling interest of Pacific Western Oil Corp. with possible subsequent mergers of oil interests including Sunray Oil Corp., Skelly Oil Co., Tide Water Associated Oil Co., and Mission Corp.

The reports start from the known negotiations providing for the purchase of a controlling interest in Pacific Western by Eastman, Dillon & Co. from J. Paul Getty and the George F. Getty estate. The purchase would include the small stock interests in Pacific Western not owned by the Getty family. The Pacific Western's crude-oil production is about 9,000 bbl. daily.

Pacific Western, according to a recent report, owns 641,808 shares of the 1,374,145 shares of outstanding stock of Mission Corp. which has a small production but which is primarily an owner of stock in Skelly Oil Co. and Tide Water Associated Oil Co. Pacific Western also owned 577,854 shares of the 6,408,132 shares of outstanding stock of Tide Water Associated at the close of 1946. Mission Corp. owns 1,345,593 shares or approximately 21 per cent of Tide Water Associated and 582,657 shares or approximately 59 per cent of the outstanding stock of Skelly Oil Co.

The purchase of the Getty and other stock in Pacific Western, it is pointed out, would give the new owners controlling interest in the Mission Corp. and through the Mission a controlling interest in the Skelly company and through Pacific Western and Mission approximately 30 per cent of the Tide Water Associated common stock.

Sunray Oil Corp. is also involved in the reports because Eastman, Dillon & Co. has been associated as bankers in the rapid expansion of the Sunray operations over the past 5 years. It is pointed out that the position of the Department of Justice in matters affecting competing companies would be involved in merger plans and also the attitude of minority stockholders in the companies concerned. W. G. Skelly, president of the Skelly Oil Co., has stated that a merger program has not been submitted to the company which he heads. Clarence H. Wright, Sunray president, now visiting the California properties of his company, is reported to have said that part of the negotiations are still in "the negotiation stage" with the possibility of an announcement soon.

Robert T. Haslam, vice president and director of Standard Oil Co. (N. J.), center, is shown talking with W. W. Vandeveer, president of Allied Oil Co., left, and J. Howard Marshall, president of Ashland Oil & Refining Co., at last week's forty-fifth annual meeting of the National Petroleum Association in Atlantic City. Haslam was one of the principal speakers. Both Vandeveer and Marshall are on the board of directors of the recently organized American Independent Oil Co., Marshall being a vice president

Positive Action Needed to Combat State Controls, Haslam Says

by Warren W. Burns

ATLANTIC CITY.—Explaining how the trend toward stateism and nationalization abroad has resulted in control of foreign oil operations, Robert T. Haslam, vice president and director of Standard Oil Co. (N. J.), last week told National Petroleum Association members at their forty-fifth annual meeting here, that the same type of governmental control could become more than a remote eventuality in the United States unless positive steps were taken to prevent it.

Positive steps, Haslam explained, have already been taken by the American Petroleum Institute's public-relations operating committee, which should be known as an industry-wide activity and not merely A.P.I.

At the regular monthly meeting of the public-relations committee, also held last week in Atlantic City, preliminary plans were outlined whereby the current oil-industry public-relations program would be broadened to include everyone who earns his living from petroleum operations in the United States.

In his address on "Freedom Is What You Make It," Haslam, speaking primarily as a member of the public-relations committee rather than as a Jersey Standard executive, effectively pointed out how nationalization abroad has already affected the oil industry in various places. Approximately 600 NPA members and guests heard him say:

"To the south of us, the oil industry is nationalized in Mexico and Bolivia. In Argentina more than half of the production is reserved to a government company (Yacimientos Petroliferos Fiscales), which refines and distributes its products. This has resulted in government-sponsored agreements between marketers which restrict competition. Refining is nationalized in Uruguay (Administracion Nacional de Combustibles Alcohol y Portland) and any refining and producing which may be undertaken in Chile are reserved to the government (Corporacion de Fomento de la Produccion).

"To the north of us, the oil industry is practically a public utility in the Canadian Province of British Colombia. Prices of gasoline there are fixed by a public-utilities commissioner, and in Nova Scotia the price of gasoline is under public-utility board control. Last July the province of Prince Edward Island made distribution of kerosine, heating oils, and fuel oils a public utility. However, last week the province rescinded these regulations and returned oil operations to private industry.

"In Europe the oil industry is nationalized in Spain. In Portugal over half of the industry is in the hands of a government company, and quotas are assigned to the balance of the industry. In France the government has fixed quotas and percentages for all oil companies and through the Chambre des Syndicales issues orders regulating the oil industry in detail.

"In Italy, still largely disorganized, the oil industry operates under a system of quotas. In England the government has announced that the petroleum pool will be dissolved by the end of this year, or as soon thereafter as is practicable, but as of today the industry there is operating under an arrangement which has merged all gasoline distribution and obliterated brand names. In Switzerland the industry, the dealers, and the government want a cartel that will fix prices and volume quotas, and, of course, take away most of the freedom which a company normally has to compete.

"This past spring in Sweden a committee appointed by the Riksdag recommended nationalization of the oil industry. Fortunately, after a campaign of education by the industry and other groups interested in freedom for the Swedish economy, the recommendation was discarded, at least for a year and a half." This, Haslam pointed out, is a good example of what public relations can accomplish.

U. S. Directly Concerned

Because these nationalization activities are happening outside the borders of the United States, we may be inclined to comfort ourselves with the thought that we are not directly concerned, the speaker said, adding that "any such thought is sheer delusion." Activities abroad which affect the oil industry, he said, have a direct relationship with domestic oil operations "because the political pattern, the economic system, and the laws that are in effect in a country, or in the world, have a tremendous influence on how we work, how we live, and what we can contribute to our country and society."

Citing the small percentage of Communists (17 per cent) which was active in the Hungarian Government last year, and which eventually took over control of that country, Haslam urged that the power of a small minority with a crusading spirit never be underestimated. He also pointed out that by coincidence 17 per cent is practically the same percentage as the A.P.I. public-relations survey found favoring oil-industry nationalization in the United States.

Dovetailing his observations on oil nationalization abroad directly into the oil-industry public-relations program in this country, Haslam said: "There is still a tremendous job ahead. We have only begun to get

(Continued on page 150)

New Record Texas Production Due Under October Allowable

TEXAS crude-oil production, now running at all-time record levels, promises to go even higher in October under the allowable order issued September 17 by the Texas Railroad Commission.

The commission's order provides the first general exemption from shutdown days since 1938 and set an allowable designed to produce some 2,376,000 bbl. daily.

Texas production the week ended September 20 totaled 2,333,755 bbl. daily, unchanged from the previous week.

Only field in Texas held to shutdown days in October was East Texas which was placed on a 22-day schedule. This action was contrary to expectations since reservoir pressure dropped 5 psi. in July and 3 psi. in August. The October allowable will give East Texas field a 4,265-bbl. increase to 325,570 bbl. daily.

All other fields in the state will thus be given an opportunity to produce at their most efficient rates in view of the unprecedented demand for crude oil.

The October allowable represents a decrease of 9,478 bbl. daily for the state from the September 13 allowables. However, William J. Murray, Jr., commission member, said revision of schedules as a result of removal of shutdown days may more than offset this decrease. The new schedule will reduce underproduction by taking allowables away from wells shown to be unable to produce and give the production to better wells, the commissioner said.

Total net allowable for October is 2,555,224 bbl. daily with underproduction figured at 7 per cent. Together with anticipated production of 197,958 bbl. daily of natural gasoline and distillates in October, total output of liquid hydrocarbons in the state would be 2,574,316 bbl. daily. U. S. Bureau of Mines estimate of demand for Texas crude oil in October was 2,300,000 bbl. daily. Purchasers advance nominations asked 2,703,138 bbl. daily.

OCTOBER ALLOWABLES BY DISTRICTS

	October Allowable	Change from Allowable of Sept. 13
Dist. 1 (SW)	26,063	—167
Dist. 2 (SW)	174,167	—285
Dist. 3 (Gulf Coast)	540,530	—7,959
Dist. 4 (SW)	273,119	—4,933
Dist. 5 (E)	42,826	—97
Dist. 6 (E)	123,243	—2,204
East Texas	325,570	+4,264
Dist. 7-B (W Cen.)	49,362	+1,118
Dist. 7-C (West)	43,642	—1,297
Dist. 8 (West)	685,517	—10,106
Dist. 9 (N Cen.)	170,153	+2,898
Dist. 10 (Panhandle)	101,032	—576
Total	2,555,224	—9,478

New Oil Credit Organization Formed

OIL-COMPANY credit representatives meeting September 15-17 in Chicago organized the American Petroleum Credit Association to supplant the Petroleum Division of the National Association of Credit Men, and elected L. E. Jones, Arkansas Fuel Oil Co., Shreveport, president.

Association members said the new organization will continue to support activities of the National Association of Credit Men.

Other officers elected were W. W. Rogers, Pure Oil Co., Chicago, vice president; and named as regional vice presidents — D. E. Burroughs, Shell Oil Co., New York; J. A. Walker, Standard Oil Co. of California, San Francisco; and A. E. Fletcher, Standard Oil Co. (Ohio), Cleveland.

H. E. Butcher, Cities Service Oil Co., Chicago, was named treasurer and S. J. Haider, secretary, which was the post he filled in the Petroleum Division.

Speaking at the meeting on marketing problems, L. W. Bernhard, credit coordinator of Standard Oil Co. of New Jersey, said that although large companies are absolutely necessary to get the marketing job done, two-thirds of it will be carried on by jobbers who are of growing importance to the prosperity of the industry. The independent jobber in the next few years will have a chance to expand his business, much of which is done on credit, Bernhard added.

R. G. Gordon, division credit manager of Shell Oil Co., Inc., St. Louis, said that much credit-department pressure has been removed by the demand for petroleum products brought about by converting coal and gas to oil. Commenting on the credit risk Gordon said that in good times little sustained effort is made to check ratings. Domestic heating-oil credit is no longer in the blue-ribbon category, he said, because many burners have been sold during the past several years to an undesirable class of trade.

Crude Runs, Completions Again Set New Records

TWO more new records in petroleum-industry operations have been established. Well completions during August surpassed all previous marks while crude-oil runs for the week ended September 13 topped all previous high levels.

Completions for August were 3,402, an increase of 15 over the previous record of 3,387 for July and an increase of 234 over the second highest previous monthly record of 3,168 in July 1937.

The nation's runs to stills for the week ended September 13 averaged 5,318,000 bbl. daily, compared to the previous all-time record high of 5,271,000 bbl. the week ended August 2.

The largest increase in the runs to stills was in the Texas Gulf Coast and the Indiana, Illinois, and Kentucky districts which showed increases of 70,000 and 19,000 bbl. daily, respectively.

Light Airplane Tests Butane-Propane Fuel

Butane and propane were put to a new use September 17 when a mixture of the two light hydrocarbons powered a light airplane in an experimental flight at the Municipal Airport in Oklahoma City.

The flight using butane-propane fuel was the first made under the official supervision of the Civil Aeronautics Administration. The plane took off with regular aviation gasoline, and the pilot switched to the butane-propane for a 20-minute flight.

Fuel system used was devised by Landrum L. Hughes, Oklahoma City. The butane is vaporized near the engine's hot-oil lines and passed into the regular carburetor. Hughes claimed several advantages for the use of butane-propane, among them reduction of engine wear, more even power, elimination of carbon formation, an even temperature for the oil, and substantial savings in fuel costs.

Reno Oil Buys Oklahoma Oil Corp. for $465,000

Reno Oil Co., Wichita Falls, Tex., has purchased the entire stock of Oklahoma Oil Corp., of Okmulgee, for $465,000 and will operate the newly acquired company as a subsidiary under its same name.

The properties include leases and wells in Creek, Okmulgee, Oklahoma and Pottawatomie counties, with production between 600 and 700 bbl. daily. It also has undeveloped leases in western and central Oklahoma.

this week

OFFSHORE LANDS—Texas Governor Jester names committee to carry the state's fight against any effort at federal control of Texas' offshore areas. . . . Committee includes 254 county Democratic chairmen as well as other state political and school leaders. . . . ¶Federal Government marks time in California "tideland" case with the issue expected to come to a head in Congress next year. . . .

RECORDS—Nation's refineries again reach new high in total crude-oil runs to stills. . . . A.P.I. report for week ended September 13 shows runs at a daily average of 5,318,000 bbl. . . . ¶Compilation of The Oil and Gas Journal places total number of well completions during August at 3,402, a new high in this phase of industry activity. . . .

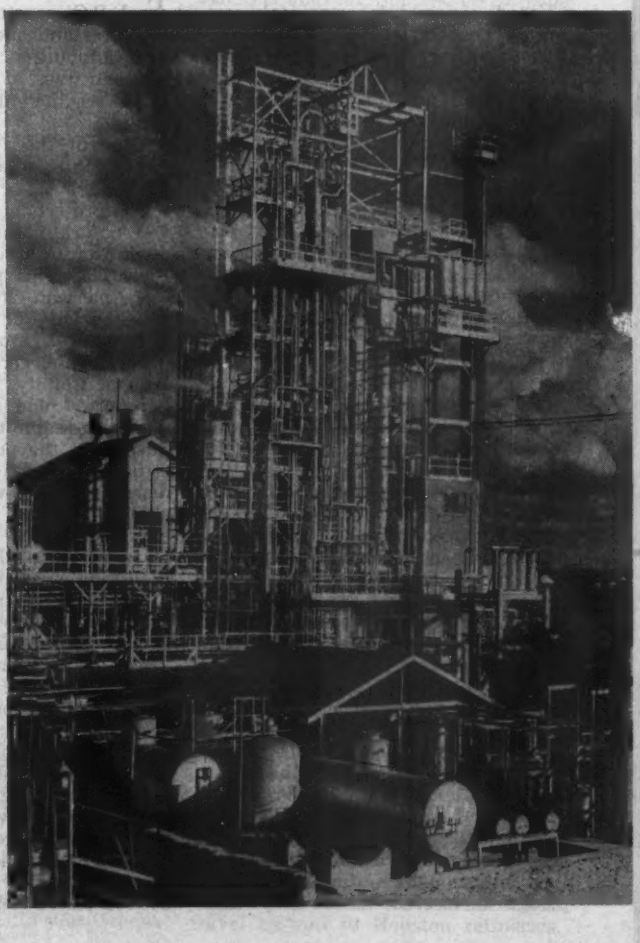
REGULATIONS—Texas Railroad Commission sets October allowable designed to give daily production of 2,376,000 bbl. daily. . . . October order provides first general exemption from shutdown days since 1938 with only East Texas field held to a schedule. . . . ¶Texas state officials call conference for September 25 to investigate complaints that explosions in offshore seismograph operations are causing serious damage to fish life. . . . ¶Railroad Commission indicates announcement will be made soon setting current market price for sweet gas to be used by carbon-black manufacturers. . . .

U. S. GOVERNMENT—Secretary of the Interior Krug sends letters to all refiners in the nation of more than 10,000 bbl daily, assigning voluntary quotas for sales to federal government agencies. . . . Plan receives approval of Department of Justice. . . . ¶High-level government committees study United States' ability to export to aid in European rehabilitation. . . . Sixteen western European nations asks $22.4 billions, including $2.2 billion in oil and products from dollar sources. . . .

PIPE LINE—New 33-mile, 20-in. gas line from Carthage field to near Longview, Tex., approved by FPC. . . . Line to be built by United Gas Pipe Line to deliver gas to Big Inch connection and into United's Dallas district system. . . . ¶Elk Refining Co., Quaker State Oil Refining, and South Penn Oil offer to buy shares of Eureka Pipe Line Co. . . . ¶Cities Service lets contract for the construction of housing and other facilities at Ulysses, Kans., as first step in its $36,000,000 Hugoton-Kansas City pipe-line project. . .

EXPLORATION—Prospects good for two new Anadarko basin pools in western Garvin County, Oklahoma. . . . ¶150-bbl. flow well revives interest in Mush Creek field near eastern rim of Powder River basin, Weston County, Wyoming. . . . ¶Two Ector County, Texas, wildcats hit for good wells in Ellenburger. . . . ¶Fain & McGaha 1-A Amos and Andy, Strawn discovery in North Central Texas, flows 110 bbl in 11 hours. . . . ¶Stanolind gets good well to open field in Matagorda County, Texas. . . . ¶New deep gas-condensate sand found by Superior wildcat in Four Isle dome, Terrebonne Parish, South Louisiana. . . .

INTERNATIONAL—Decision on approval of application of Trans-Arabian Pipe Line to export pipe for Persian Gulf-Mediterranean line checked to secretary of commerce and top government interdepartmental policy committee. . . . Company discloses some engineering features of the line which is planned for five pump stations in addition to one at Ras Tanura. . . . ¶German occupation officials study proposal under which German refineries would process 2,000,000 tons of Arabian crude a year beginning in May 1949. . . . ¶Fire burning for 13 days in Poza Rica well 6 extinguished, Pemex officials announce. . . . ¶Paraguay decrees government monopoly in distribution and sale of petroleum products. . . .



This installation is illustrative of the effort currently being given by the oil industry to improve various methods of synthetic production of liquid hydrocarbons. The plant is an experimental synthesis unit of Standard Oil Co. (N. J.) at Baton Rouge, La. Standing seven stories high, it produces about 150 gal. daily of a mixture of gasoline, diesel fuel, and chemical products

European Nations Ask 2.2 Billion Dollars in Oil From Dollar Areas

WASHINGTON.—Exports of petroleum products from the United States to Europe under the "Marshall Plan," if and as the program is accepted by Congress, will be a compromise between what the 16 asking nations want and what our Government feels can be spared.

The 16 Western European countries meeting at Paris have just completed a schedule of aid required during the 4 years 1948-51 totaling $22.4 billions, including $2.2 billions of dollar oil. A summary of this consolidated 4-year European rehabilitation plan was released by the State Department September 22, and details will be published later this week.

However, the ability of this country to export petroleum, as well as other products, will be determined by two government committees which have not yet completed their reports.

Last spring President Truman appointed an interdepartmental committee headed by Secretary of the Interior Krug to survey this country's resources and capacity to produce. The report of this group will be ready in about 2 weeks and will contain a chapter on petroleum. Another committee of 19 prominent citizens, headed by Secretary of Commerce Harriman, is still at work estimating how much this country can spare for exports. A small technical committee from the oil industry is being asked to assist in checking the estimates on future domestic petroleum requirements.

Not Much New

These reports probably will not contain much that is new to the oil industry since they are expected to follow the numerous private forecasts of world supply and demand in coming years. However, they will point up the prospect that the United States will not be a net exporter in the future and that foreign supply sources must be depended on for the large consuming areas outside of this nation on a long-range viewpoint. On the other hand, the reports probably will not be able to get away from the prospect that sizeable exports of petroleum products from the United States will be needed for foreign relief and rehabilitation.

The request for United States aid under the Marshall plan is based on a program developed by the 16-nation committee of European Cooperation under which these countries pledge themselves to develop their own resources with a view to becoming self-sufficient by 1951. One of the items in this program is a plan to increase oil-refining capacity in Western Europe to two and one-half times the prewar level, or to 17,000,000 tons annual crude-oil throughput.

The estimate of $2.2 billion of petroleum needed during the 4-year period includes only oil from dollar sources, that is, from the United States and foreign operations of American companies outside the sterling area, and would be in addition purchases from British, Dutch, and other companies in sterling countries.

Five Natural-Gasoline Projects Announced

FIVE new natural-gasoline and L.P.G. construction projects, four in Texas and one in Oklahoma, have been announced. Work is now under way on two of the projects, while plans for the others have been projected.

Four of the five projects involve expenditures totaling a reported $17,000,000.

The projects are:

A natural-gasoline plant in Silsbee pool, Hardin County, Texas, costing $3,000,000. This plant is to be built by American Republics Corp. and Houston Oil Co.

A natural-gasoline plant in Barnhart Ellenburger field, southeastern Reagan County, Texas. This project is reported planned by a Texas group which has submitted contracts to producers for the purchase of gas. Construction of the plant and its size depends on the volume of gas available.

An addition to the natural-gasoline and recycling plant of Humble Oil & Refining Co. in Kay field, northwest Harris County, Texas. Contract for the work has been let to Stearns-Roger Manufacturing Co., Denver. The Kay installation, now producing nearly 5,500 bbl. daily of light fractions, will be doubled as a result of the new project.

A natural-gasoline plant of Skelly Oil Co. in Stephens County, Oklahoma. Born Engineering Co., Tulsa, has commenced work on this project, with L. W. Garret in charge. Cost is estimated at about $5,000,000. The plant is expected to process some 30,000,000 cu. ft. daily from Velma and West Velma pools. Completion is due next May.

Cycling plant under construction by Gray Wolfe Co., Houston, in Pinehurst field, Montgomery County, Texas. Plant costing estimated $2,000,000 will process about 13,000,000 cu. ft. daily, producing condensate and L.P.G. fractions. O. L. Olsen, Houston, has the contract with completion due next January.

It was reported last week Superior Oil Co. has placed in operation an 8-in. pipe line from Altair field, Colorado County, Texas, to its Lake Creek cycling plant in Montgomery County.

Prior to announcement of this latest set of projects in Texas, compilations showed that 10 Texas plants extracting natural gasoline from previously flared gas are due for completion by January, and 54 other projects outlined for construction. These 54 plants represent expenditure figured at $75,000,000.

Construction of gas-processing plants, particularly in Texas, has been given impetus by efforts of state regulatory bodies toward greater utilization of oil-field gas.

Texaco Reserves Set At 1,216,638,000 Bbl.

THE Texas Co. has estimated its proved domestic oil reserves as of January 1 at 1,216,638,000 bbl. and natural-gas reserves at 5,964,232,000,000 cu. ft. Foreign oil reserves have been set at 2,607,000,000 bbl. with more than 92 per cent of the total credited to Saudi Arabia. Since the first of the year the foreign reserves have substantially increased, according to a company statement.

The company credited 90,000,000 bbl. of reserve oil to Bahrein Island on the Persian Gulf; 72,000,000 bbl. to Venezuela; 20,000,000 bbl. to Colombia; 20,000,000 bbl. to Sumatra; 5,500,000 bbl. to New Guinea; and 2,400,000,000 bbl. to Saudi Arabia.

Texaco is planning to make capital expenditures of approximately $170,000,000 this year, of which $89,000,000 will be allocated for exploration, development, and acquisition of producing properties. Daily crude-oil refining capacity of the company as of June 30, 1947, was 408,900 bbl., but this will be increased as soon as new equipment can be put in operation.

One of the company's major projects, which started last May, is an East Coast refinery near Camden, N. J., which is being designed to process both domestic and foreign crude oils. Completion is expected by July 1949. Work on new equipment and modernization of existing facilities is also under way or planned for refineries at Port Arthur, Tex., Casper, Wyo., West Tulsa, Okla., and Lawrenceville, Ill.

DR. GUSTAV EGLOFF | DR. W. E. KUHN | C. G. KIRKBRIDE | A. A. O'KELLY | B. H. SHOEMAKER

New officers of the Petroleum Division of the American Chemical Society for the year 1947-48 are: chairman, Dr. Gustav Egloff, Universal Oil Products Co. (reelected); vice chairman, Dr. W. E. Kuhn, research director, The Texas Co.; secretary-treasurer, C. G. Kirkbride, Houdry Process Corp.; and executive committee members, A. A. O'Kelly, Socony-Vacuum Oil Co., Inc., and B. H. Shoemaker, Standard Oil Co. (Ind.)

Chemists Announce Many New Processes at A.C.S. Meeting

by Arch L. Foster

NEW YORK.—The chemistry of the origin of petroleum, synthetic processes for hydrocarbons, new chemicals from petroleum fractions, hydrocarbons from waste organic materials, and the use of high pressures in chemical research are only a few of the many subjects discussed by the Petroleum and Organic Chemistry divisions of the American Chemical Society at its semiannual meeting here September 15-19. Eleven thousand members of the society met and discussed every phase of American and world chemical progress and pointed the direction of tomorrow's discoveries.

The origin of oil occurs at too low temperatures to permit its natural synthesis to be explained by hign temperatures and pressures, Virginia Burton told the chemists. Recent research at Massachusetts Institute of Technology has shown that the effect of radioactivity present in the materials from which nature produced petroleum may be the answer to its manner of synthesis, she said. Straight-chain or paraffinic hydrocarbons may be formed by irradiating with alpha particles, or deuterons, fatty acids known to exist in sedimentary geologic beds. Cyclic or ring compounds such as benzene may be so formed from a cyclic acid, Miss Burton said. Hydrogen produced from these reactions may be used by nature to hydrogenate unsaturated hydrocarbons formed, as deuteron bombardment of oleic acid in the M.I.T. cyclotron showed formation of stearic acid, the corresponding saturated acid.

Waste organic materials, in profuse abundance in much of the world, may become the cheapest source of raw material for the water-gas reaction to form hydrogen and carbon monoxide for the Fischer-Tropsch synthesis of hydrocarbons and oxygenated products, C. C. Wright, Pennsylvania State College, and R. F. Mitchell, Consolidated Mining & Smelting Co., Canada, told the A.C.S. delegates. Heated to glowing temperature and in a stream of oxygen, these waste materials show good conversion to the water-gas products, although probably not competitive with other raw materials as yet, the authors said.

Fluorine as Catalyst

Preparation of chlorinated hydrocarbons, from which many other products are synthesized, is hastened by the introduction of fluorine, the "lightest" of the halogen elements, Prof. E. T. McBee and Prof. J. A. Bittles, Purdue University, announced. This plan permits effecting these reactions at much less severe conditions than has formerly been the case. Fluorine to catalyze the reaction of chlorination need be present in only one-twentieth the amount of chlorine present, they stated.

The "dream of every fluoride chemist to have a transparent and practically usable material to work with the (fluorine) acids" has been realized, said Dr. Aristid von Grosse, research director, Houdry Process Corp., announced at the meeting. Containing no sand (silica), the new lass resists the action of uranium, hexafluoride, and hydrofluoric acid, which dissolve ordinary glass readily. This new glass is another product which was developed as a result of the research which resulted in the atomic bomb. *(Another report on the A.C.S. meeting appeared in the Oil and Gas Journal, September 20, page 156).*

New Facilities Boost West Texas Shipments

WITH pipe lines unable to carry the extremely heavy load of outgoing crude from West Texas, the completion this month of Shell Pipe Line Corp.'s loading-rack additions will provide a sizeable boost to oil shipments from that area. Increasing the rack from 10 to 32 risers will bring total rail shipments from McCamey to almost 500,000 bbl. a month.

Other racks already functioning in the area include: Humble Pipe Line Co., a double rack with 50 risers; and Texas-New Mexico Pipe Line Co. which started shipments August 31 from its 14-riser rack.

The second half of September is expected to show a daily average of 12,000 bbl. of crude shipped from McCamey by Shell for an approximate monthly total of 200,000 bbl., while Humble expects to show a total shipment of 170,000 bbl. from McCamey for September, and Texas-New Mexico a total of 100,000 bbl. for the month.

Shell routes its oil by rail to Roxana, Ill., for processing, with some possible shipments to Houston refineries. Humble is shipping by way of San Angelo and Temple to Milano and from there to Longview where it moves by pipe line to tankers on the Gulf Coast. Texas-New Mexico will travel by rail to Houston refineries.

International

WORLD-WIDE OIL DEVELOPMENTS

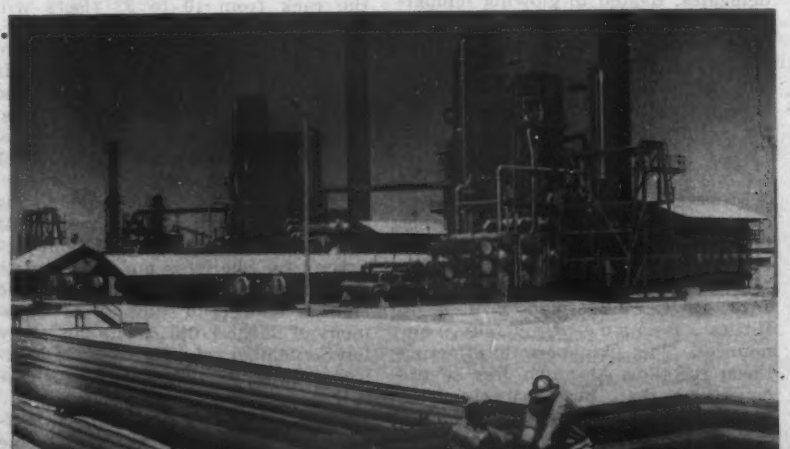
Plans Outlined for Trans-Arabian Pipe-Line-Station Construction

by Paul Reed

ON his recent return from Arabia, B. E. Hull, president of Trans-Arabian Pipe Line Co., predicted that the 1,050-mile project of his company from Saudi Arabia to Sidon, Lebanon, will be completed sometime in 1949. During construction, Hull will direct operations from company headquarters at both San Francisco and Beirut, Lebanon.

Rolling of 30 and 31-in. pipe by Consolidated Steel Corp. for the Trans-Arabian pipe-line project will be carried on simultaneously in parallel operations which will get under way at the end of September at the Los Angeles plant. Special equipment has been developed for denesting the 30-in. from the 31-in. after it is unloaded. New equipment also has been devised for automatic-welding operations in fabricating the pipe into multiple-joint sections prior to delivering in the field. As a result of this procedure the amount of field welding will be reduced.

First shipments are expected to arrive in Arabia early in December. Pipe laying will begin late in January at the eastern end of the line contracted by Bechtel International Corp. As certain sections are completed crude oil will be pumped into the line where it will be accumulated steadily in order that the entire line may be filled shortly after the project is finished. Construction by Williams Brothers Overseas Co. at the Mediterranean end will commence in March. Pipe-laying operations for the entire project are expected to be well under way in May of 1948.



The initial station of the Trans-Arabian Pipe Line system will be located at the Ras Tanura refinery of Arabian American Oil Co.

In addition to the initial station on the grounds of the Arabian American Oil Co. refinery at Ras Tanura on the Persian Gulf, there will be five main-line stations, each to be equipped with large pumping units. Each of the units will consist of a Worthington diesel engine driving a Byron Jackson centrifugal pump through Falk increaser gears.

Each of the large units will be driven by a 1,700-hp. Worthington solid injection 4-cycle, 8-cylinder diesel engine with 16-in. bore and 20-in. stroke to operate at 360 r.p.m., with an Elliott Buchi supercharger.

Preliminary Test

To insure satisfactory operations for this distant foreign project, the first large pumping unit will be given a complete test at the Worthington plant before shipment. The unit tested will include engine, gear set, and pump under load conditions for period of a week or 10 days in April 1948. West Texas crude oil with characteristics similar to Arabian oil will be provided for the test. The initial plan calls for installing four of the units. A fifth unit of the same type will be procured for later installation.

There will be 10 or 11 electric-generator units installed at the five main-line pump stations. The plan is to install two of these units at five stations, and probably three units at one station. This third unit will be available as a spare to be shipped where needed. Each of the generator units will have a 1,320-hp. Worthington diesel engine driving a 800 kw. generator at 360 r.p.m.

The unusually large power requirements result from demands of the Arabian project including: operation of booster pumps to insure sufficient suction pressure at the large units; operation of radiator fans for cooling jacket water and lubricating oil; also air conditioning and electric cooking of residences, offices, etc., at the camps.

Because the oil passing through the line will be too hot for cooling by the customary modern heat-exchanger method, radiator-type cooling will be employed. At each station there will be two groups of radiators. Each of these groups will be connected with a common water system. One of

(Continued on page 149)

Report Outlines Economic Position Of Colombian Oil Industry

COLOMBIA'S original surface rentals, in the proposed new oil bill which has been presented to that country's Congress, have been scaled down 40 per cent for grants elsewhere than in the Llanos region.

The proposed rentals for wildcatting for the first 3 years were dropped from 75 centavos per hectare (2.47 acres) per year to 45 centavos (26 cents) and from the fourth to the seventh year 1.50 pesos per hectare per year to 90 centavos (51 cents). The 30-centavos (17 cents) per hectare per year rental for Llanos grants were retained for the first 5 years, and for the second 5 years Llanos grants have been dropped from 80 to 60 centavos (35 cents), a 25 per cent cut, according to the proposal.

If a wildcat is drilled, surface rentals would be cut 50 per cent further for Llanos grants and 66 per cent elsewhere. Other legal modifications remain to be made in the original draft.

Petroleum Minister Tascon and Colombia's National Petroleum Council has prepared a comprehensive draft of the domestic and international background of the oil industry and Colombia's oil economic problems in relation to the provisions of the proposed oil bill.

Objectives

The objectives, briefly, are to promote widespread and technically sound exploration; to discover and develop commercial oil economically; to have most of Colombia's crude oil refined domestically; to permit construction of pipe lines and facilitate oil transportation; to promote a greater degree of cooperation in the industry; to effect an equitable distribution of oil profits; to promote social progress; and to participate to a greater degree in supplying the world oil market with crude oil and refined products.

Colombia's National Petroleum Council estimates that of the country's 113,915,500 hectares, 46,748,000 hectares are most favorable to the development of commercial oil; 6,038,000 hectares are moderately favorable; and 3,101,000 hectares are possibly oil bearing. This is a total of 55,887,000 hectares, or almost 50 per cent of Colombia's total area.

As of July 24,1947, and since 1931, a total of 504 concession bids had been filed with the ministry covering 27,963,723 hectares. Of this number, 1,659,592 hectares, or 29 concessions, are active. Sixteen concessions are still in force and 27, or 48 per cent, have been surrendered. Currently there are 27 concession bids ready to be converted into contracts. The ministry is studying 194 applications.

In the commercial concessions, 1,592 wells have been drilled, 1,520 of which were producers and 72 dry holes. Only 106 wildcats have been drilled in Colombia since 1931. Before this date only 81 wildcats had been drilled. There are five commercial fields in the country's three producing concessions.

In a study of exploration costs, made by Colombia's National Petroleum Council, it was shown that 275 pesos ($157) was for geology; 125 pesos ($71) for surface fees; 92 pesos ($52) for land rights; and 200 pesos ($114) for wildcat drilling. This study was on a basis of unit outlay per hectare of firm concessions. The costs include outlays made outside of those mentioned here.

Distribution of Income

Distribution of oil income for the three commercial concessions, for the period 1939-1945, shows that the proceeds were split substantially as follows, on a barrel cost basis (United States money): 25.7 cents to the government; 39.3 cents to industry and 35.3 cents to labor. Percentagewise, this is 25.6 per cent to government; 39.2 per cent to industry, and 35.2 per cent to labor.

In discussing Colombia's international competitive position, the council's report shows that the average f.o.b. laid-down cost (all figures in United States currency) was as follows: United States—$0.645; Venezuela—$0.545; Colombia—$0.64; Ecuador—$0.53; and Peru—$0.78. In 1946, the council explains, Colombia's laid-down cost jumped to $0.77 per barrel, or a 20.4 per cent increase.

Middle East per barrel costs, (also in United States currency) are shown as: Iran—$0.27; Saudi Arabia—$0.315; Bahrein—$0.355; Iraq—$0.485; and Kuwait—$0.28.

In view of Colombia's disadvantageous competitive position, on the above cost basis, the council's report calls for a favorable oil legislation to create an incentive and alleviate that country's economic burdens. However, opinions of well-informed oil men in New York indicate that little hope is held out for favorable action by the present Colombian Congress.

T.L.L. August Output Down

Trinidad Leaseholds, Ltd.'s production from its own fields for August showed a slight decrease. Output for August was 534,065 bbl. or a daily average of 17,228 bbl. as compared to the total production of 542,854 bbl. for July, a 17,551-bbl. average.

Resumption Seen for Sumatra Operations

N. V. STANDARD-VACUUM PETROLEUM MIJ., operating affiliate of Standard-Vacuum Oil Co., in the Netherlands East Indies, expects to resume operations in the south Sumatran oil fields and at its war-damaged Palembang refinery the latter part of this year.

Rehabilitation work has been under way for more than a year at the Soengei Gerong, Palembang, refinery for more than a year, and the company hopes to resume with runs of about 20,000 bbl. daily. The refinery before the war had a crude capacity of 45,000 bbl. daily, 32,000 bbl. daily cracking, and operated wax-production facilities. The company's 500-bbl. daily skimming plant at Kapoean, Java, remains shut down.

Company representatives reentered the south Sumatran fields about August 1 for the first time since 1942. A field survey is now being made, and it is expected conditions will become sufficient stable to allow production later this year.

These fields include: Talang-Akar and Pendopo, 1941 daily average production of 24,143 bbl. with 211 flowing wells with an average producing depth of 2,900 ft.; Djirak, 1941 daily average production of 6,630 bbl. from 112 flowing wells and one pumping with an average depth of 900 ft.; and Benakat, 1941 daily average production of 9,786 bbl., from 140 flowing wells with average depth of 1,500 ft.

Definite Plans for Italian Exploration Not Completed

Plans for oil exploration in Italy by Societa Petrolifera Italiana, an affiliate of Standard Oil Co. (N.J.), are as yet indefinite, according to E. C. Borrego, general manager of the company.

It was reported earlier *(The Oil and Gas Journal, August 16, page 60)* that the company had intensified operations and had petitioned the Italian Government for rights in a 6,000-sq. mile area of the Po Valley.

Borrego said the company had not as yet concluded its negotiations with the Italian Government and that it did not know how much money would be employed in any program. The only work under way, he added, consists of running some seismic profiles on old permits the company has held in Italy for years.

Principal Structural Elements and Possible

Oil and Gas Resources of Southern Border of European Part of U.S.S.R.

by I. O. Brod*

THE problems involved in the creation of the Great Donetz Basin and in the search for new large oil-bearing zones within the vast plains in the south of the U.S.S.R. are intimately related to the question as to the age and structure of the basement of the southern part of the Russian platform. Numerous gas occurrences known in the near-Caspian, Kalmyk-Salsk, North Caucasian, and Crimean steppes, as well as in the Melitopol region, are usually considered as gas accumulations lying at shallow depths and having a purely local significance. As a matter of fact, the basement of the above-listed regions being made up of folded structures of different age, the prospects of economic gas and oil possibilities of these regions are to be viewed in a quite different light.

In the central regions of the Russian platform drilling has revealed the occurrence of the pre-Cambrian basement at depths not exceeding 2,000 m. (6,560 ft.). In the southeast the area of an uplifted occurrence of pre-Cambrian rocks stretches in a belt from the Voronezh massif to the Ufa plateau. The southern slope of the uplifted zone, well traceable from data of magnetic and gravimetric surveys, plunges nonuniformly towards the foot of the Caucasian and Crimean mountains. This plunge is interrupted by great uplifts, as a result of which the pre-Cambrian has at places been brought out to the day's surface (Azov-Podolia massif).

There is no doubt as to the subdivision of the basement east of the above-named region either, where the presence of a buried range postulated as early as by A. P. Karpinsky, was confirmed by data of subsequent geophysical research. F. F. Golynetz and N. G. Uspenskaya, who explored this region, considered the buried structure, in accordance with the views of A. P. Karpinsky, as a connecting link between the Mangyshlak Mountains and the folds of the Donetz Basin. The geophysical exploration of the subsequent decade, generalized in 1940 by E. E. Fatiadi and after him by A. A. Borissov, showed that the buried range traceable in the Kalmyk-Salsk steppes is probably a plunging extension of the folds of the western slope of the Urals. Indications as to the meridional trend of the dislocations on the Chushka-Kul elevation and east of it make us assume the existence of a branching of the Uralian system of folds shown in the scheme. As to the Mangyshlak Mountains, they probably form a part of another folded structure. This mountain chain, formed by the movements of the Cymmerian cycle, stretches along the southern edge of the platform, which adjoined at that time the Hercynides of the south-western extension of the Urals.

*Professor of geology and mineralogy at Moscow Petroleum Institute and Moscow State University.

Geosynclinal Folding

In the Mangyshlak region typical geosynclinal forms of folding have been recorded for the Permian and the Triassic. During the Lower Jurassic the geosynclinal regime began to die away. At the Jurassic time the Mangyshlides were the northern dry land which supplied material for the formation of sediments in the geosynclinal area situated south of them. The New-Cymmerian movements were but slightly reflected by the Mangyshlak zone, and during the Alpine orogenic process it was already a part of the platform.

One of the links of the Mesozoic mountain structure as that represented by the Mangyshlak region seems to be the Dobrudja elevation on the Danube, where the relations in the nature of the dislocations of deposits of different age are known to be analogous to those of the Mangyshlak region. During the Alpine mountain-making Dobrudja, as well as Mangyshlak, were already a part of the platform. North of Dobrudja the Mesozoic deposits are concealed again under the mantle of younger sediments. The buried extension of this structural zone may be traced in a barrier-like elevation bordering the cis-Carpathian depression from the east. Drilling on this barrier-like elevation has revealed a chain of local structures, associated with accumulations of gas in Tortonian beds in the areas of Opara, Dashava, Kalushi, etc., which are the greatest in Europe.

The presence of a considerable number of oil occurrences in the Mesozoic deposits of Mangyshlak suggests a regional occurrence of oil and gas in this zone. The slight metamorphization of the rocks permits to expect the preservation of hydrocarbon compounds. West of Mangyshlak —in the cis-Caucasus and in the Crimea, i.e., where the Cymmerides are buried under a considerable thickness of Tertiary and post-Tertiary sediments, natural-gas occurrences are likely to be present in the rocks covering the Cymmerian basement. Methane, formed as a result of decomposition of the petroleum bitumens during the sinking of the folded structure, must have migrated from strata under pressure produced by overlying strata. In connection with this, the problem of a search for all the remaining links of the buried folded structure of Cymmerides (Mangyshlides) throughout the area between Mangyshlak in the east and the Dobrudja elevations in the west, is one of great importance in the development not only of the gas-producing, but also of the oil-producing industry of the U.S.S.R.

Young Uplifts

The accompanying map shows that in the zone bounding the piedmontite down-warping of the Crimean-Caucasian mountains from the north the Cymmerian basement is likely to be found throughout the area from the Tarkhankut elevation on the North Crimea to the Caspian Sea. The presence of young uplifts in this zone was recorded in recent years by M. M. Zhukov on the divide of the Terek and Kuma rivers at Cherny Rynok and by V. G. Loewinson, on the Eisk Peninsula. The existence of the Blagodarnensky uplift was recorded by the author as early as 1926-1927 and has been confirmed by the explorations of M. M. Zhukov. Between the Blagodarnensky and the Cherny Rynok uplift a gravity anomaly is known, viewed as a gently sloping anticline of a Caucasian trend.

While considering the above-mentioned zones of distribution of buried folded systems—the Hercynides (Uralides) and Cymmerides (Mangyshlides), it is necessary to point out that the structures of the Caucasus and the Crimea, lying to the south, should be considered, as it is seen from the map, as links of a single Alpine belt interrupted by areas of plunges across the strike of the folds.

The zones of propagation of the simultaneously uplifted folds can be traced on the basis of a zonal subdivision of the geosynclinal area, of the pre-Cambrian platform, being regularly surrounded by Caledonides, Hercynides, Cymmerides, and Alpides. These zones must probably have displayed the most outspoken geoanticlinal tendencies during the period of the geosynclinal regime throughout the cycles of orogenesis. At each phase of movements the arising folded structures became welded to the platform as a result of consolidation in the marginal part of the geosyncline closely approaching the platform. At the same time in the inner, remote parts of the geosyncline, upheavals were followed by new sinking movements. The ranges formed earlier and involved in these plunges were overlain by younger sediments, with a subsequent rise during the next great paroxysm of orogenesis.

Within the Crimean-Caucasian zone intense folding movements have been recorded for the New Caledonian, Hercynian, and Old Cymmerian phases, but the critical stage must have been reached during the New Cymmerian phase, for it was not until that time that ascending movements acquired primary importance. The general sinking of the geosyncline did not compensate for them any longer. It should be noted that by this time the Crimean-Caucasian zone was the frontal part of the geosyncline, since the Mangyshlak folded zone had already been consolidated and welded to the platform.

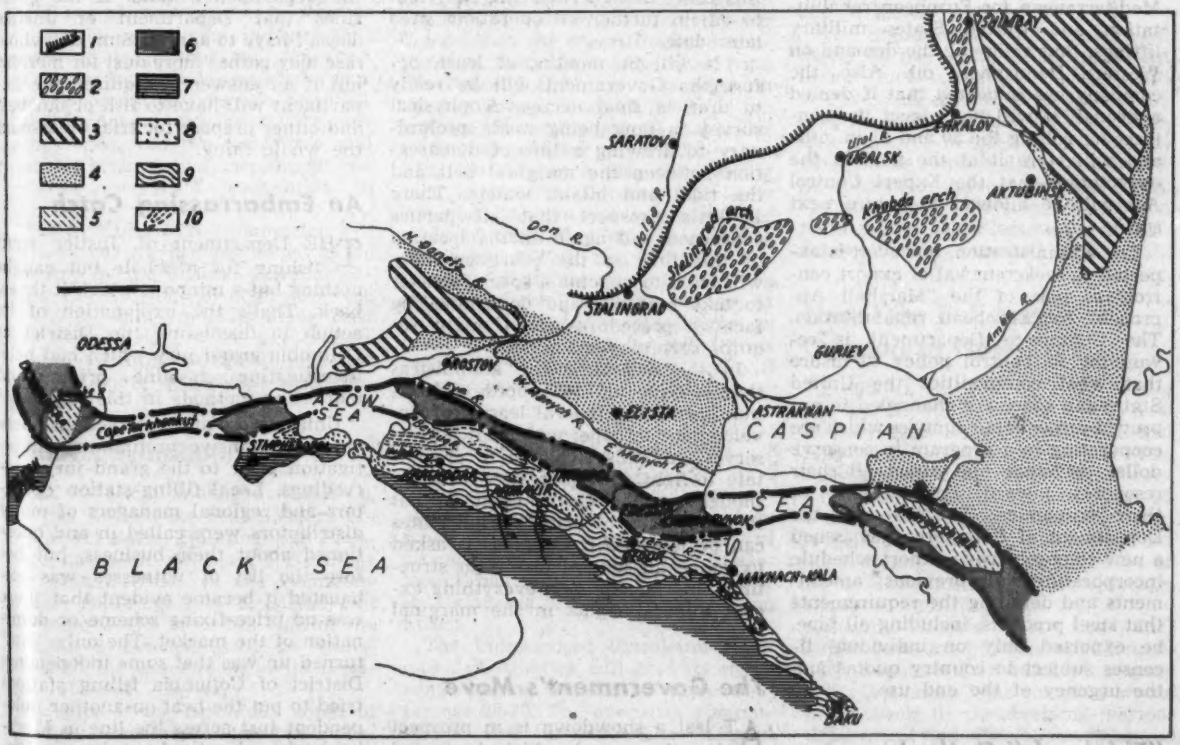
Vertical Shifts

The development of movements within the Crimean-Caucasian zone proceeded from the center towards the periphery. During the early Paleozoic phases were formed the folds of the present core of the Great Caucasus. During the Mesozoic time originated the folding in Mesozoic deposits, while the older folded basement was subjected to block shiftings only. During the intermediate period intense vertical shifts took place in the consolidated Mesozoic folded structure, while the Tertiary sediments were gathered into folds.

It should be borne in mind that a map of the outlines of the pre-Cambrian base of the platform surrounded by a ring of Caledonian folded structures was compiled as early as by F. N. Chernyshev.

The possibility is not excluded that future drilling will confirm the presence in the southern part of the Russian platform not only of buried Hercynides and Cymmerides, but also of zones of Caledonides traced by F. N. Chernyshev. In the map are shown the Khobda and the Stalingrad platform arches, in the core of which folds of the Caledonian structure are probably enclosed.

The hypothetical schemes of the structure of depths in the regions covered by a thick mantle of flat-dipping sediments do not reflect the actual state unless there is a clear understanding of the fundamental relationships between the present morphological forms and the structural elements, which originated at different stages of geologic history. All the processes which are taking place in the earth's crust are to a greater or lesser degree reflected in the present structures of the various principal rocks, formed as a result of consecutive tectonic movements. Owing to this, the present morphological forms of the earth's surface often show marked traces of very ancient phenomena.



Structural map of the southern border of the European part of the U.S.S.R. (1) Edge of the pre-Cambrian basement of the platform. (2) Platform elevations with supposed Caledonian folded basement. (3) Hercynian folded structures on the surface. (4) Supposed buried extension of Hercynian folded structures. (5) Cymmerian folded structures on the surface. (6) Supposed buried extension of the Cymmerian structures. Alpine folded structures. (7) Area composed of Mesozoic and older deposits. (8) Frontal anticlinal zones in Tertiary deposits. (9) Supposed buried uplifts. (10) Depressions of the piedmontite downwarping

WASHINGTON WATCHING

BY HENRY D. RALPH

Trans-Arabian's Pipe

WASHINGTON.—The application of the Arabian American Oil Co. for a license to export steel pipe to commence construction of the Trans-Arabian pipe line is admittedly one of the toughest problems facing the export-supply branch of the Commerce Department.

Rolling of the pipe is scheduled to start at once, and the company wants to begin shipments so that laying can be advanced before the intense summer heat in the desert. So an early decision is imperative. Lower-level committees in the export-license body have passed the matter on up without recommendation, and decision rests with the secretary of commerce and his top policy interdepartmental committee.

Despite the opposition of domestic oil interests who say the steel is vitally needed here, the chances are somewhat in favor of granting the export license on the ground that it would make oil available in the eastern Mediterranean for European rehabilitation and United States military liftings, thus relieving the demand on Western Hemisphere oil. Also, the company has indicated that if denied a license, it will not cancel the contract for rolling the 30 and 31-in. pipe and will store it at the port in the expectation that the Export Control Act will be allowed to expire next spring.

The administration, however, is expected to seek renewal of export controls as part of the "Marshall Approach" for European rehabilitation. The Commerce Department is revamping its control policy to insure that what commodities the United States can spare are channeled to approved projects in countries which are cooperating in a program to conserve dollar exchange and direct all their resources toward improvement of their economies. To this end the Department of Commerce has issued a new comprehensive export schedule incorporating all previous amendments and detailing the requirements that steel products, including oil pipe, be exported only on individual licenses subject to country quotas and the urgency of the end use.

"Tidelands" Outlook

WHATEVER the Supreme Court may do in the "tidelands" case at the opening of its October term will not alter the status of things, and there is no change in sight for many months.

The proposed decree submitted by the Department of Justice is little more than a pro forma assertion of the court's decision that the federal Government owns the bed of the Pacific Ocean between the low-tide mark and the 3-mile limit, reserving further action of the court for some time in the future.

The State of California did not avail itself of the opportunity to submit a suggested decree draft, but will oppose the Government's draft because the state is asking reconsideration of the entire case. The court may dispose of both these motions next month, but whatever action it takes could hardly upset the stipulation under which the offshore oil wells are being operated with royalties held in escrow. This stipulation runs through next summer unless Congress takes action in the meantime, and the Department of Justice takes the position that a detailed decree would be improper at this time, though reserving the right to enjoin further oil operations at a later date.

It will be months, at least, before the Government will be ready to draft a final decree. A physical survey is now being made preliminary to drawing a line of demarcation between the marginal belt and the tidal and inland waters. There is little prospect that all parties concerned will agree on the location of this line, so the court probably will have to appoint a special master to take evidence and determine the facts, a procedure which might require several years.

In the meantime the administration is expected to propose legislation permitting federal leases for development of the undersea oil reserves, and this is bound to precipitate a fight in Congress. Prevailing thought in the Government is that the opposition of many coastal states can be lessened if Congress is asked to waive all federal claims to structures, marine life, and everything except mineral rights in the marginal sea.

The Government's Move

AT last a showdown is in prospect in the much kicked-around "Mother Hubbard" antitrust suit against the American Petroleum Institute and all major oil companies. The federal District Court of the District of Columbia has set October 1 as the date for argument on the motion of the Department of Justice to deny the request of Sun Oil Co. that the Government answer a leng list of interrogatories specifying just how the company committed the illegal acts alleged in the general language of the blanket complaint.

The department doesn't want to answer these questions. It finds the interrogatory rather embarrassing, but its opposition will be based on legal technicalities rather than an admission that it is not ready to go to trial on the issues. The "Mother Hubbard" case has been kicking around since 1940, and almost nobody believes it will ever be brought to trial in its present form. For political appearances, however, the department doesn't want to drop it until it can say that all issues have been covered by separate suits against the individual defendants.

Most of the defendants appear perfectly willing to let the case lie dormant on the court docket, but Sun is pressing for action, trying to force the department's hand. If the court rules that Department of Justice doesn't have to answer Sun, the whole case may gather more dust for months, but if an answer is required the department will have to fish or cut bait and either prepare for trial or dismiss the whole thing.

An Embarrassing Catch

THE Department of Justice went fishing for a whale but caught nothing but a minnow, which it threw back. That's the explanation of its action in dismissing the District of Columbia grand jury which had been investigating gasoline prices and marketing methods in this region.

Unlike most antitrust actions there was no extensive preliminary investigation prior to the grand-jury proceedings. Local filling-station operators and regional managers of major distributors were called in and questioned about their business, but before the list of witnesses was exhausted it became evident that there was no price-fixing scheme or domination of the market. The only "dirt" turned up was that some independent District of Columbia filling stations tried to put the heat on another independent just across the line in Maryland who advertised gasoline at District of Columbia prices and adsorbed the 1-cent increase in the Maryland gasoline tax.

This was such small fry that the department preferred to come back

from its fishing expedition with an empty creel and try again in other waters another day. When the local investigation was announced, it was ballyhooed as part of a big antitrust drive to bring down prices. The department now says its study of the oil industry will be continued and other investigations will be brought later.

New L.P.G. Tank-Car Rule

A SLIGHT improvement in the number of tank cars available for transportation of L.P.G. this winter will result from an order just issued by the Interstate Commerce Commission permitting the use of types 104A and 104A-W for shipment of butane and propane mixtures.

During November and between March 16 and April 15 the pressure in these cars may not exceed 92 psi. at 105° F., and during the middle of the winter the pressure may not exceed 110 psi., and shipments are not to be made to areas where the temperature is above 75° F. These shipments may be made only under individual permits from the ICC Bureau of Service. A similar procedure was in effect last winter as an emergency measure to relieve the shortage of L.P.G. cars.

New A.P.I. Radio Committee

THE use of radio by many branches of the petroleum industry has grown so large that the American Petroleum Institute has created a new central committee on radio facilities. Appointments to this group are now being made, and the committee will hold its organization meeting at the time of the A.P.I. convention in November.

The first task of the committee will be to survey the licenses issued to the industry by the Federal Communications Commission to determine the extent to which radio is being used for communication in exploration, remote drilling locations, pipe-line work, offshore operations, and shipping.

American Independent

THE American Independent Oil Co. has opened its headquarters office at 111 Sutter Building, San Francisco, and soon will open a Washington branch office in the Commonwealth Building, 1625 K Street. But for some weeks more the bulk of the company's business will be transacted in the hotel room of its president, Ralph K. Davies.

In spite of the ambitious hopes of the new organization to obtain producing concessions in the Middle East, the company is far from a going concern. Davies already is deluged with applications for jobs and offers to sell equipment, but so far the company needs few men and no machinery because it has no properties and not even an exploration permit. A few key men are being recruited, both from the constituent oil companies and from elsewhere in the industry, but no appointments have been announced.

The immediate objective of the new venture is to obtain drilling rights somewhere in the Middle East, and at present it is giving no thought to operations elsewhere. But some time in the future it may turn its attention to development of new production in South America, the Orient, Alaska, or within the United States. Therefore it was decided that San Francisco would be as good a location as any for its headquarters, plus the fact that the Golden Gate's distance from Wall Street emphasizes the "independent" nature of the company. The Washington branch will be maintained because the company intends to deal primarily in the foreign field, necessitating continual close contact with the Government.

Davies Gas-Supply Company

THE embryonic Trunkline Gas Supply Co. has not been abandoned by its creator, Ralph K. Davies, as a result of his present preoccupation as president of the new American Independent Oil Co.

This project was launched by Davies some months ago. He filed an application with the Federal Power Commission for a certificate to construct a natural-gas pipe line from the Texas Gulf region to a point on the Mississippi River in Iowa for the purpose of selling gas to numerous transmission lines it would cross. FPC has not set a date for hearing this application because the new company has not yet assembled the required data showing its ability to obtain and sell gas and to finance the project. Agents are currently at work obtaining commitments to sell gas to it in the Gulf region, and as soon as a sufficient supply is assured, Davies says the construction application will be pressed before the commission.

Oklahoma City to Open Oil Week September 30

With several important meetings scheduled and a large gathering of oil men expected, September 26-October 4 has been proclaimed Oil Week in Oklahoma City by Mayor Allen Street.

The Independent Petroleum Association of America will hold its eighteenth annual convention there September 28-30. The executive committee of the Interstate Oil Compact Commission will meet September 30 to make arrangements for the fourth quarterly meeting of the compact in Oklahoma City December 4-6. Oklahoma Petroleum Marketers will hold their second annual clinic and meeting October 3. The monthly market-demand hearing of the State Corporation Commission will be held September 30.

Pacific Coast Gas Group Hears Talk on L.P.G.

Greater recovery of propane offers the most likely source of additional liquefied petroleum gas for the West Coast, Harold L. Costello, Standard Oil Co. of California, told the Pacific Coast Gas Association at its fifty-fourth annual meeting this week in San Diego.

"In California, substantially all the butane is now being recovered," he asserted. "This is not true of propane, and large additional supplies can be produced if economically justified. The trend has definitely been from butane to propane for the last 2 or 3 years. Practically all the consumer storage installed during that time has been for propane."

In his discussion, Costello emphasized the phenomenal growth of the L.P.G. Business on the West Coast as well as throughout the country generally during the last few years. "At the present time," he said, "one coast manufacturer is turning out 10,000 L.P.G. carburetors per year; another plant is producing six large L.P.G. engines daily. . . . The people of 47 cities in this area are dependent on L.P.G."

The Standard of California official described use of L.P.G. as truck and tractor fuel—a method that was developed and pioneered in California. Engines to use L.P.G. are being factory built, or a truck or tractor engine can be converted for about $250, he continued. Advantages for L.P.G. engines include: material reduction in maintenance costs; less motor-oil consumption; and increased power.

New Esso Building Opened in New York

Standard Oil Co. of New Jersey has begun its move into the new 33-story Esso Building where it will consolidate all its departments. The building, a new addition to the Rockefeller Center Group, is located at 15 West Fifty-First Street in New York. It will take from 6 to 8 weeks for the company to complete the move of all its departments that now occupy space in four buildings.

Socony-Vacuum Oil Co., Inc., which owns the building at 26 Broadway, announced as quickly as space is made available the company would bring back to the building various department and divisions now housed in six other addresses in the lower Broadway district. When the moves are completed about December 1, Socony-Vacuum will occupy all the building except four floors to be utilized by Standard-Vacuum Oil Co.

Wherry Releases Results of Survey Of Majors, Independents

FIGURES indicating that major oil companies are expanding marketing operations at a greater rate than independents were made public September 19 in Washington by the petroleum subcommittee of the Senate small-business committee as it prepared to conduct two more hearings into petroleum supply and distribution problems.

The subcommittee was scheduled to hold hearings September 24 in Omaha and September 26 in Kansas City, Mo., under Sen. Kenneth S. Wherry. The Tulsa hearing set for September 26 has been cancelled. Witnesses asked to appear at Omaha and Kansas City include a number of jobbers and distributors as well as officials of several major oil and pipeline companies.

The data announced by the subcommittee in Washington was based on questionnaires covering 100 refineries operated by major companies and from 113 independent refiners. The operations surveyed were in 23 states.

According to Wherry's announcement, the replies showed the following:

Both major and independent refineries reported increases in crude-oil processed (1947 over 1946, first 6 months); 3.6 for the majors, and 4.1 for the independents.

The major-company refineries processed 557,941,000 bbl. of crude during the first 6 months of 1947 as compared with 96,269,000 bbl. processed during the same period by the independent refiners.

Major-company refineries were operating in 1947 at 94.6 per cent of capacity, while the independents were operating at 69.5 per cent of capacity.

More refined products (14.1 per cent) were distributed through company-owned bulk stations by majors, 1947 over 1946. This represents 11,889,000,000 gal. in 1947 (first 6 months), as compared with 10,418,000,000 gal. in 1946.

At the same time, the 113 independent refiners reported an increase of 25.9 per cent in sales of refined products to other refiners.

A.P.I. Fuel-Conservation Booklet Nearly Complete

Orders already have been received for nearly 500,000 copies of the booklet, "How to Save Money on Oil Heating," now being prepared under the supervision of the fuel-oil conservation committee of American Petroleum Institute's Marketing Division.

The booklet, scheduled for distribution the latter part of October, is similar to the one which was produced by the Petroleum Industry Committee for District 2 during the war. Cost of the forthcoming A.P.I. booklet runs to about 6 cents each.

The publication details ways in which fuel-oil users can obtain maximum results from oil heat. In a brief introduction, it explains that the long-range oil-supply outlook is good and outlines the petroleum industry's current expansion. The oil-conservation committee is headed by Wesley I. Nunn, manager of the advertising department of Standard Oil Co. (Ind.)

Another publication on fuel-saving practices was announced last week by the U. S. Bureau of Mines. Material used during the war in the fuel-efficiency program has been combined in a single publication now available for 50 cents each from the U. S. Government Printing Office.

Over-All Fuel Supply Adequate, Hulcy Reports

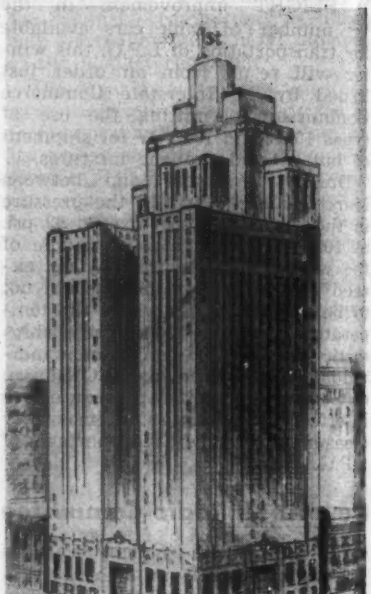
WASHINGTON.—The nation's over-all supply of fuel will be adequate for the coming winter contingent upon normal weather conditions and freedom from strikes and transportation tieups, according to a report made to the board of directors of the United States Chamber of Commerce by D. A. Hulcy, chairman of the chamber's natural-resources department committee and president of Lone Star Gas Co.

The report emphasizes that there may be local shortage due to transportation difficulties, but these, should they occur, are expected to be of short duration and to cause no widespread difficulties.

Supplies of heating oil available to the nation during the coming winter should be adequate to meet requirements even though the over-all demand for petroleum products will be 6 to 6½ per cent greater than a year ago. Some of the natural-gas transmission companies were able to increase capacities during this summer, but, because of shortage of pipe, the additions will not be adequate to prevent curtailment of some classes of natural-gas service in some locations this winter when weather conditions are severe.

Sunray, Tulsa Bank Plan New Office Building

Sunray Oil Corp. and the First National Bank & Trust Co. of Tulsa have projected plans for the construction of a 24-story office building at Fifth Street and Boston Avenue in Tulsa. The new building will be built and occupied by the two organizations which have capitalized at $1,000,000 the Fifth and Boston Corp.



Sketch of the new office building to be built in Tulsa by Sunray Oil Corp. and the First National Bank and Trust Co.

Sunray is expected to occupy five floors and the bank, the same number. The remaining floor space will be available for other tenants. Sunray, which purchased the property from John E. Mabee, independent oil operator, has not disclosed any definite date for construction to begin. Completion will require about 2 years.

The new building will provide additional space for other companies needing adequate office space. C. H. Wright, president of Sunray, announced that the company had completely outgrown its office space and that the move is in line with a general expansion program.

Ohio Oil Replaces Bonus

Ohio Oil Co. has announced a plan to replace the current flat $35 per month cost-of-living bonus which has been paid since last January 1. The plan provides a general wage increase of 15 cents per hour for all regular hourly-rate employes effective October 1 and a bonus of 10 cents per hour.

PERSONALS

Van Duzee Now Manager For Shell in New Orleans

E. N. VAN DUZEE, recently appointed manager of Shell Oil Co., Inc.'s New Orleans area, has been with Shell since 1926 when he graduated with a degree in mining engineering from the University of Minnesota, where he starred in football.

He served as exploitation engineer for West Texas and New Mexico until 1931 when he took over the duties of production foreman at McCamey, Tex. Later he was transferred to the Louisiana division as district foreman and soon thereafter became district superintendent at Iowa, La.

In 1939 he was moved to the Mid-Continent area as acting division manager and after a year returned to the Texas-Gulf area as manager of the Louisiana division. This was the position he held before receiving his latest appointment as manager of the recently created New Orleans area.

This new administrative area is headquartered in the Richards Building, New Orleans, and is a part of the Shell's reorganization and expansion program.

David Dolson, manager of the branded-sales division of the Roosevelt Oil Co., has been named assistant to the general manager of Simrall Corp. as of September 15.

Samuel D. Koonce, formerly of the research division of Distillation Products, Inc., has joined the sales department of Jefferson Chemical Co., Inc., New York. He will be engaged in market research and in liaison work between the sales department and the technical and research department of Jefferson.

Arthur Highman, chemical engineer for Oronite Chemical Co., has been named manager of the market-research department. He succeeds **S. H. Manifold** who was promoted and transferred to the sales department as assistant to the manager.

Arthur R. McQuiddy, formerly a Roswell, N. M., newspaperman, has been appointed executive secretary of the New Mexico Oil & Gas Association. McQuiddy succeeds **Jack W. Campbell,** who will remain with the association as legal and tax advisor.

J. Rex Wolfe, superintendent of inventories and materials for Mid-Continent Petroleum Corp., has been advanced to assistant purchasing agent in the materials department. **Fred J. Seybold,** superintendent of field warehouses, will take over the duties of Wolfe.

Prof. H. A. Laitinen, of the department of chemistry at the University of Illinois, has begun the second half of his 3-week lecture course for technical and research personnel of Humble Oil & Refining Co.'s Baytown (Tex.) refinery. He succeeds **Dr. E. R. Gilliland** of the Massachusetts Institute of Technology.

John H. Melvin, former treasurer of Pennsylvania Drilling Co., has been appointed state geologist of Ohio. He recently served as head of the geology subsection for U. S. Army Corps of Engineers in the Omaha district.

B. M. Berry, division supervisor in charge of engine oils for Standard Oil Co. of California, has been named as assistant manager of the products-acceptance department. He succeeds **R. W. Goodale,** recently named manager of the lubricant division of the marketing department.

Frederick Meyer, of the process department, Bayway (N.J.) refinery, Standard Oil Co. of New Jersey, has been promoted to shift foreman in the atmospheric distillation department and **James A. Allcroft** has been promoted to a similar position in the paratone plant.

John R. Reeves, general superintendent of Republic Light, Heat & Power Co., has been elected vice president. **Donald A. Hamilton,** assistant treasurer of Republic and also of Dominion Natural Gas Co., has been elected treasurer of both companies, and **D. P. Spencer,** assistant secretary, has been named secretary of the two companies.

John W. Scheuber, field inspector for the San Angelo district of the Oil and Gas Division of the Texas Railroad Commission, has been transferred to the Midland office. Two other transfers to the engineering department of the Midland office were: **Lamar Exchberger,** from Austin, and **Elmo G. Weyel,** from San Antonio.

Robert I. Stirton, research chemist in the oil business since his graduation in 1934 from the California Institute of Technology, has been appointed manager of the product-development division of the Oronite Chemical Co. of San Francisco.

Dr. H. R. Snow, former assistant general superintendent, has been appointed plant manager of the Texas City refinery of Pan American Refining Corp. He will succeed **P. J. Sweeney** who will devote full time to his position of first vice president of the company and Mexican Petroleum Corp of Georgia. Snow became associated with Standard Oil Co. (Ind.) in 1925 working in laboratory research and plant operations. **B. F. Babin,** head of the light-oils department, succeeds Snow as the assistant general superintendent in charge of operations. He has been at Texas City since the beginning of plant operations in 1933. **P. A. Stewart** will succeed Babin. Other changes in the Texas City plant include: **W. A. Sullender,** former assistant department head, who will succeed **J. B. Hamblen** as head of the catalytic and distillation department. Hamblen will be transferred to Pan American Petroleum Corp. at Destrehan, La., to head the manufacturing department there.

W. G. Heltzel, former vice president and general manager of Stanolind Pipe Line Co., has returned to Tulsa from San Francisco where he has been doing consulting work for several months for the Trans-Arabian Pipe Line Co. project. He

PERSONALS

is preparing to leave for Rio de Janeiro at the end of September to be gone 3 weeks for consulting work for the petroleum council of the Brazilian Government.

Byrnes MacDonald, who joined Sinclair Oil Corp. in 1946 as executive assistant to the president, has been appointed assistant director of public relations and advertising for Sinclair and subsidiaries.

Paul Netterstrom, former geologist with Ohio Oil Co., is now with Barnsdall Oil Co. as Rocky Mountain geologist at Casper, Wyo.

A. G. Anderson, general traffic manager, Socony-Vacuum Oil Co., Inc., New York, and **J. L. Burke,** vice president, Stanolind Pipe Line Co., Tulsa, have been elected to the board of directors of the Transportation Association of America.

John W. Gladson, former administrative assistant to the comptroller of Standard Oil Co. of New Jersey, has been appointed assistant comptroller. He succeeds **George O. Ingram.**

Denver E. Perkins will resign as district attorney of the Twenty-fifth Judicial District of Texas to accept a position on the legal staff of the Cities Service Oil Co. in Houston, effective October 1.

Frank B. Conselman, former Abilene (Tex.) district manager for American Trading & Production Corp., has resigned to open an office in Abilene as an independent consulting geologist.

R. V. McElhany, former sales manager of Nebraska Producing & Refining Co., Salem, Neb., has been appointed general manager of Saunders Petroleum Co., Kansas City, Mo.

M. W. Sheppard, Jr., former production engineer and executive for Shell Oil Co., Inc., has been named manager of the land department in the Pacific Coast territory, effective October 1.

Robert N. Sears, formerly assistant to **A. J. McIntosh,** economist for Socony-Vacuum Oil Co., Inc., has resigned to work for **Ralph K. Davies,** president of the newly organized American Independent Oil Co. Sears, who has been with Socony-Vacuum for about a year, formerly was assistant to the program director of the Petroleum Administration for War.

E. W. Allgower, former assistant treasurer of Standard Oil Co. (Ohio), has been named treasurer.

R. E. Luton, manager of the refining division of Ohio Oil Co. at the Robinson, Ill., refinery, has been transferred to the general office in Findlay, Ohio. Other refining and marketing personnel who will be affected by the move include: **M. W. Nicholas,** assistant to the manager of the refining division; **L. B. McCammon,** manager, refined products supply and transportation department; **A. I. DeWeese,** assistant manager, refined products supply and transportation department; **N. T. Stover,** general sales manager; and other sales officials.

P. G. Carpenter has been named section chief of production research in the physics division of the research

P. G. CARPENTER

T. A. MATTHEWS

MORRIS

H. B. FISHER

department, Phillips Petroleum Co., Bartlesville, Okla. Carpenter, formerly with Hercules Powder Co., Wilmington, Del., graduated from the University of Wisconsin where he received a Ph.D. Group leaders named to serve under Carpenter include: **T. A. Matthews,** in charge of reservoir engineering; **W. L. Morris,** production physics; and **H. B. Fisher,** production chemistry. Matthews has been with Phillips in reservoir work since receiving his M.S. degree from the University of Arkansas. Morris, who graduated from Duke University with a Ph.D. degree in mathematics, was formerly with Gulf Research & Development Co. and Kuwait Oil Co. Fisher, who received a Ph.D. degree in physical chemistry at the University of Illinois, formerly was with Aluminum Co. of America and Darce Corp.

A. J. Kraemer, U. S. Bureau of Mines official, and **H. M. Thorne,** engineer in charge of oil-shale experiments at the Bureau of Mines' station at Laramie, Wyo., have left on an around-the-world trip to investigate oil-shale plants. They will visit Australia, South Africa, Portugal, and Spain.

Shifts

R. M. Wemple, engineer, Pan American Production Co., Harlingen to Lyford, Tex.; **William O. Waid,** engineer, Continental Oil Co., Alice, Tex., to Ville Platte, La.; **E. E. Watson,** superintendent, Stanolind Oil & Gas Co., Alvin to Blessing, Tex.; **Samuel H. Miller,** engineer, Gulf Oil Corp., Beaumont to Daisetta, Tex.; **C. A. Browning,** geologist, Helmerich & Payne, Iraan, Tex., to Maysville, Okla.; **Lawrence W. Coldren,** superintendent, Pure Oil Co., Livingston to Nacogdoches, Tex.

C. E. Jennings, engineer, Stanolind Oil & Gas Co., Longview to Greggton, Tex.; **John Cuvelier,** superintendent, Rowan Drilling Co., Midland, Tex., to Hobbs, N. M.; **H. V. Harden,** superintendent, Magnolia Petroleum Co., Premont, Tex., to Lake Charles, La.; **George E. Burton,** geologist, Sun Oil Co., Tyler to Gainesville, Tex.; **H. W. Swain,** engineer, Continental Oil Co., Wichita Falls, Tex., to Hobbs, N. M.; **C. M. Lydy,** engineer, Socony-Vacuum Oil Co., Hammond to Gary, Ind.; **Richard D. White,** geologist, The California Co., Versailles to Lexington, Ky.

Pat H. Miller, superintendent, Texas Eastern Transmission Corp., Cincinnati, Ohio, to Shreveport, La.; **H. I. Putnam,** superintendent, War Emergency Pipe Lines, Inc., Cincinnati, Ohio, to Shreveport; **William H. Roberts, III,** geologist, Union Oil Co. of California, Laramie, Wyo., to Cut Bank, Mont.; **E. Wilfrid Walker,** engineer, Western Gulf Oil Co., Bakersfield to Pasadena, Calif.; **Patrick B. O'Rourke,** engineer, Southern California Gas Co., Los Angeles to Portland, Ore.; **O. I. Jantz,** foreman, Amerada Petroleum Co., Houma to Crowley, La.

Wesley K. Rickel, engineer, Amerada Petroleum Co., Chin Lee to Oraibi, Ariz.; **A. Eugene Zerger,** foreman, Cities Service Refining Corp., Lake Charles to Maplewood, La.; **O. C. Johnson,** engineer, Socony-Vacuum Oil Co., Inc., East St. Louis, Ill., to Webster Groves, Mo.; **William J. Hall,** foreman, Sunray Oil Corp., Bushton, Kans., to Odessa, Tex.; **E. A. Davenport,** engineer, Shell Oil Co., Inc., Oxford, Kans., to Centralia, Ill.; **O. F. Giddens,** foreman, The Texas Co., Chickasha to Marlow, Okla.; **J. E. Orr,** geologist, Sinclair Oil Co., Woodward to Seminole, Okla.

9 Per Cent of Synthetic Chemicals From Petroleum

Of a total 37 billion lb. of synthetic organic chemicals produced in 1945, 3.3 billion pounds, or nearly 9 per cent, were produced from petroleum and natural gas, according to a report recently released by the United States Tariff Commission and made possible through the cooperation of 575 manufacturers.

Sales of the petroleum-derived crude chemicals amounted to 2.8 billion pounds or $214,000,000 as compared to the total sales of 25 billion pounds or $2,200,000,000. These figures represent closely those of the previous year, 1944.

Finished chemical products amounted to 12.4 billion pounds, about half the 25 billion pounds of total crude production of synthetic chemicals.

Among the finished products, greatest gains in output were reported for surface-active agents (which include detergents), color lakes and toners, medicinals, flavor and perfume materials. Decreases were reported for dyes and miscellaneous chemicals, as compared to the 1944 output.

Bids Studied for U.S. New Mexico Royalty Oil

Bids for the seven lots of government royalty oil in New Mexico are now being studied by the U.S. Geological Survey before final awards are made. The Cooperative Refiners Association, Kansas City, Mo., has submitted the high bid of 15 cents above posted price.

Total production from the seven lots amounts to 46,130 bbl. monthly. Pools and oil, in barrels daily, involved: Brunson, 1,400; Eaves, 2,160; Eunice-Monument, 14,900; Grayburg-Jackson, 970 and 9,100; Maljamar, 14,600; and Rhodes, 3,000.

Continental Oil Co. offered the posted price, and Shallow Water Refining Co., Garden City, Kans., 5¼ cents above posted price, for the Maljamar oil. Stanolind Oil Purchasing Co., Tulsa, bid the posted price for the Eaves oil, and Malco Refineries, Roswell, N. M., offered 1 cent above posted price for the Grayburg-Jackson oil.

Wide Interest Shown in Land Bank Lease Sale

Inquiries have been received from 44 states and many large cities in the nation regarding the offer of the Federal Land Bank of New Orlenas to sell its nonproducing mineral and royalty interests of over 1,000,000 acres in Mississippi, Louisiana, and Alabama, according to R. L. Thompson, president.

Thompson announced that the bank has made additional reprints of its information pamphlet and increased facilities to handle the correspondence regarding the sale, on which bids will be received up to November 18.

Army-Navy Board's List Of Industry Men Growing

The Army-Navy Petroleum Board now has 10,000 names on its list of petroleum-experienced personnel which will be used to select men for assignment to a petroleum staff or operational unit in the event of a national emergency.

Registration is being solicited from all former service personnel who were in the oil industry before World War II or who received petroleum training while in the service and who are now back with the industry. No obligation is entailed by registering, and no assignment is given to a petroleum reserve unit.

A-NPB plans to issue a letter of general information periodically, regarding its part in reserve activities. An enrollment questionnaire may be obtained by writing: Army-Navy Petroleum Board, plans division, Temprorary Building L, Room 2021, Navy Department, Washington 25.

Recovery Conference To Open October 31

More than 100 oil operators and engineers from the Pennsylvania-Grade crude-oil region and elsewhere are expected to attend the eleventh annual Secondary-Recovery Conference on Petroleum October 31-November 1 at Pennsylvania State College, State College, Pa.

Papers will cover capillary pressure studies, selective plugging with smoke, relative permeability measurement and application, water injection in air-gas drive, and flow studies in porous media. The Pennsylvania Grade Crude Oil Association, a sponsor of research at the college, is cooperating in the conference.

An annual dinner Friday evening, October 31, will be followed by inspection of laboratories in the School of Mineral Industries, according to an announcement by Dr. A. W. Gauger, director of the college's Mineral Industries Experiment Station. Another feature of the conference will be an open forum on oil-production problems.

Petroleum Price Index Up Slightly in June

The Bureau of Labor Statistics wholesale price index for petroleum and products edged up slightly during June, but the figure was still far below the index for all commodities.

The wholesale index for petroleum and products stood at 87.5 in June, a gain of 0.7 over the previous month.

The index of wholesale prices of all commodities at the same time was 147.8, up 0.9 over the previous month.

The Bureau of Labor Statistics data is calculated with the year 1926 as the base of 100. The monthly index is figured from a monthly average of one-day-a-week prices.

P.E.P.A. Meeting Set

The Petroleum Electric Power Association has scheduled its annual conference for November 20-21 at the Robert Driscoll Hotel in Corpus Christi, Tex. The conference will be attended by invited guests from the drilling, production, pipe-line, and refining branches of the petroleum industry, as well as by association members and representatives of electrical and oil-field equipment manufacturers, according to C. L. McNeese, association secretary and treasurer.

DEATHS

Laforest John Bodine, 51, head of Bodine Drilling Co., Great Bend, Kans., died September 16 in Great Bend. Bodine, former drilling superintendent for Carter Oil Co., and later for Southern California Drilling Co., formed Triangle Drilling Co. at Wichita in 1935, and in 1946 became an independent contractor.

H. A. Meyer, retired oil man, died September 16 in Houston.

Harvey E. Shaw, 76, independent drilling contractor, died September 16 in Longview, Tex.

F. C. Bretsynder, president of Porter Oil Refining Co., St. Louis, Mo., and pioneer oil man, died September 16 in St. Louis.

Floyd L. Terwilliger, 53, production foreman for South Penn Oil Co., died September 15 in Oil City, Pa. He has been with South Penn about 30 years.

Robert Frances Donovan, 33, engineer for Bay Petroleum Corp., Denver, was killed in an automobile accident September 19 near Holly, Colo.

Walter Blaine Mallery, 58, independent oil operator, died September 17 in Oil City, Pa.

Earl Fitzpatrick, early-day oil man, died September 19 in Washington. He formerly was with the American Petroleum Products Co. before becoming a petroleum marketer.

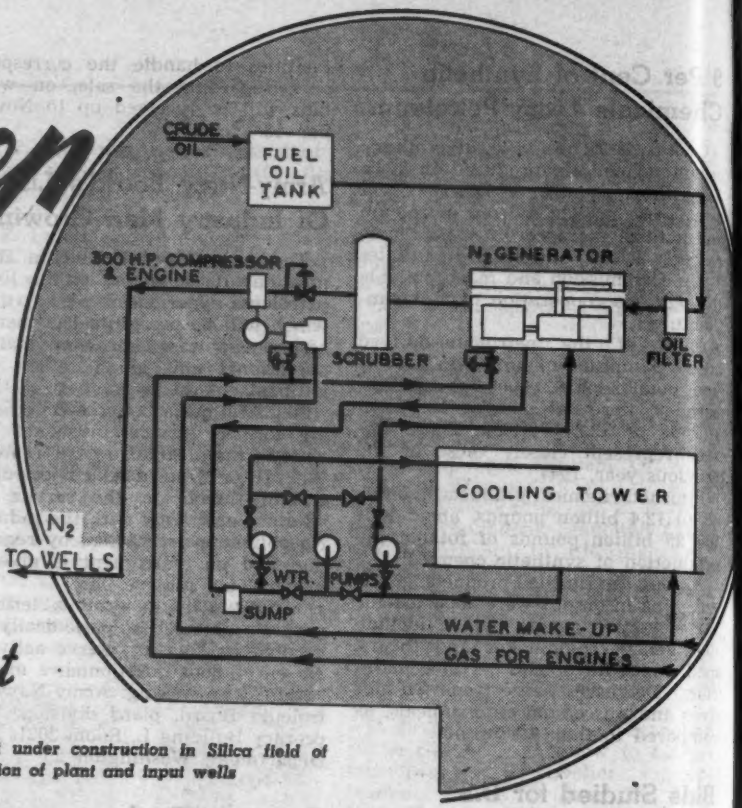
John R. Ratley, 73, credit manager for Magnolia Petroleum Co. who retired 8 years ago, died September 15 in Channelview, Tex.

Nitrogen

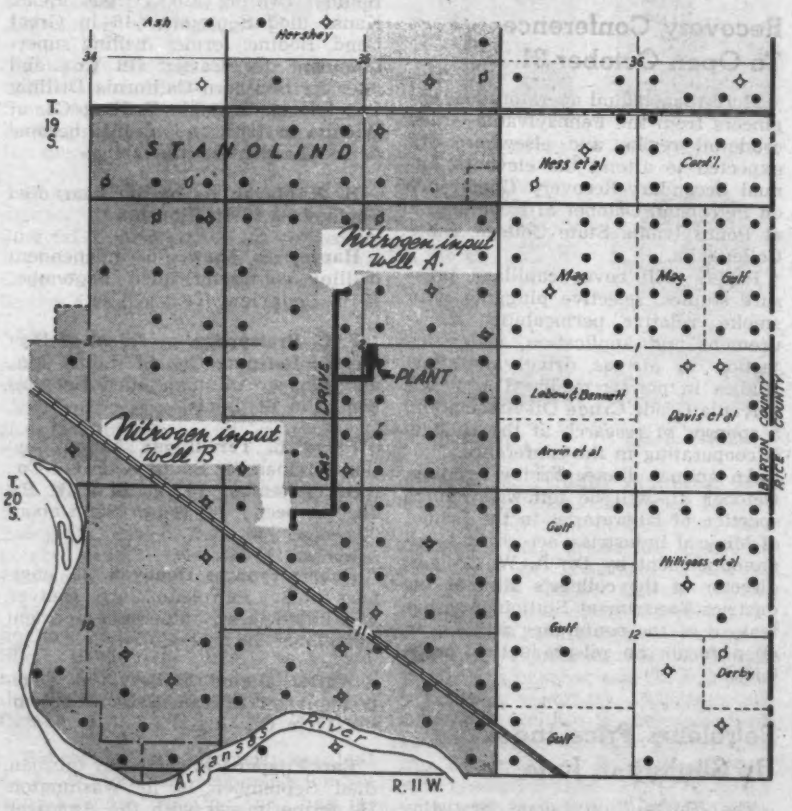
Repressuring Agent for New Experimental

SECONDARY RECOVERY

Project



Above: Flow diagram for nitrogen-generating plant under construction in Silica field of Kansas. Below: Lease map showing location of plant and input wells



by

Leigh S. McCaslin, Jr.

A NITROGEN-GENERATING plant for use in a novel experimental secondary-recovery project is nearing completion in the big Silica field of Rice and Barton counties, western Kansas. This pool is the second largest producing field in the state. The plant is being installed by Stanolind Oil & Gas Co. at a cost of approximately $70,000, to increase oil production and ultimate recovery from the Arbuckle limestone. If the project proves successful it will have great significance for Kansas as a large portion of that state's oil is produced from the Arbuckle under similar conditions.

Nitrogen was selected as the repressuring agent because of the absence of a cheap source of natural gas—a situation which exists in most of the state. Purchased natural gas for repressuring in the area would cost 15 cents per 1,000 cu. ft., which is prohibitive for the amounts required in this secondary-recovery project.

The large amount of water produced with Arbuckle crude quickly eliminated the possibility of using air as a repressuring agent. The salt water-air combination would obviously be the cause of serious corrosion problems, in addition to the explosive hazard created by aerating oil in process of production.

The nitrogen-generating plant will burn crude oil taken from lease storage. The product of combustion—a mixture of 86 per cent nitrogen, 13 per cent carbon dioxide, and 1 per cent carbon monoxide—will be compressed to 1,000 psi. and then injected into the reservoir. Injection will be through two input wells located on a large concentrated block of Stanolind leases in the west portion of the field (see accompanying map). It is planned to put 500 M.c.f. per day into each of the input wells.

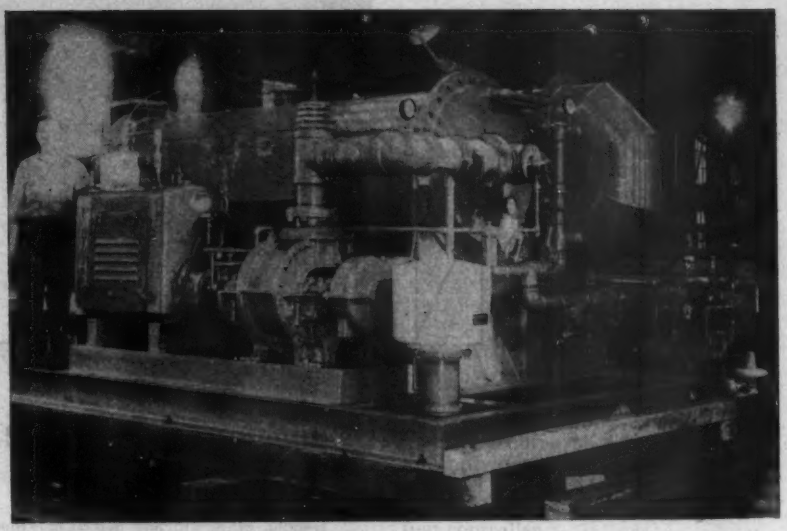
Reasons for Program

Increasing water production and rising operating costs made it evident

to Stanolind engineers, some time ago, that a secondary-recovery program was the only alternative to early abandonment of wells in this particular part of Silica field. The 24 wells in this area to be reached by the experiment are currently producing 5,334 bbl. of water and only 345 bbl. of oil—a per-well average of 14.3 bbl. of oil and 222 bbl. of water.

Experiment in Reservoir Mechanics

Stanolind engineers will make no predictions as to the possible outcome of this experiment. They consider it strictly "field research" in reservoir mechanics. The objective of the experiment is predicated upon the logical reasoning that the fundamental characteristics of limestone porosity developed by weathering and solution activity, and the absence of a free gas phase in the reservoir coupled with an extremely active water drive, are conducive to the trapping of oil in upper closures within individual pore channels as well as within small, irregular structural highs that might exist in interwell areas. Due to difference in density between oil and water, oil that is within these upper closures, either microscopic or macroscopic, cannot get out in the presence of the complete water drive. The purpose of the experiment, then, is to introduce a free-gas phase into the reservoir and allow this gas to accumulate in the upper closure in the myriad of irregular pore channels throughout the section. Thus, the engineers are evaluating the economics of "trading nitrogen for oil."



Factory picture of the 45,000-cu.-ft.-per-hour Roots-Connersville inert gas generator which is the major equipment item in the Silica plant

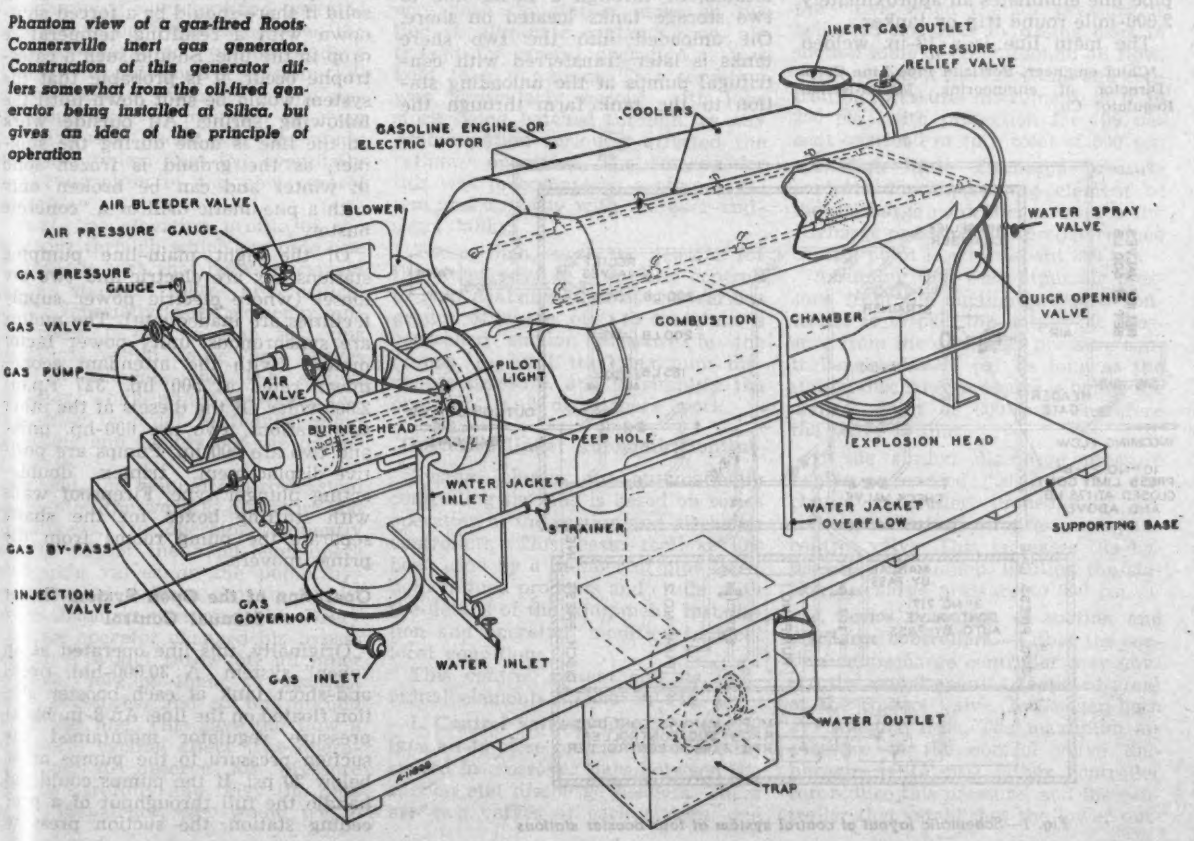
The cost of the experiment will be approximately equal to that of drilling two wildcat wells, and if the experiment proves that such technique is applicable in the Arbuckle lime reservoirs in Kansas, it will provide a whole new producing cycle for this type of reservoir which has been the predominant source of oil reserves in the state.

Nitrogen Injection Plant

A 45,000-cu.-ft.-per-hour Roots-Connersville inert gas generator is the key equipment item in the nitrogen-injection plant. As can be seen on the accompanying flow diagram, crude oil to fuel the generator is

(Continued on page 98)

Phantom view of a gas-fired Roots-Connersville inert gas generator. Construction of this generator differs somewhat from the oil-fired generator being installed at Silica, but gives an idea of the principle of operation



Automatic CONTROL

On Portland-Montreal Pipe Line

by C. D. Batchelder* and R. A. Rockwell†

THE Portland-Montreal crude-oil pipe line was originally operated by full manual control. This article will give reasons for the change-over to automatic control which has now served for over 6 months, and will show the results obtained with the new control system, and tell of the development of the control equipment in this application.

The line was constructed during 1941 as a defense measure to provide year-round deliveries of crude oil to the four refineries at Montreal. The pipe line eliminates an approximately 2,000-mile round trip by tanker.

The main line is a 12-in. welded line of seamless pipe with a wall thickness of ⅜-in. Total length is 236 miles, with 166 miles located in the United States, and 70 miles running through the Province of Quebec.

Crude oil is delivered at the new steel and concrete unloading pier at South Portland, Me. This pier accommodates two tankers at one time and unloads up to 15,000 bbl. of crude per hour. Tankers are unloaded either through a 24-in. line, approximately 3 miles long, to the tank farm where the first main-line pump station is located, or through a 16-in. line to two storage tanks located on shore. Oil unloaded into the two shore tanks is later transferred with centrifugal pumps at the unloading station to the tank farm through the 24-in. line. Combined storage capacity of the waterfront terminal and tank farm is a little over 1,100,000 bbl.

There are seven pump stations along the line, besides the initial station, spaced about 30 miles apart. These stations handle up to 70,000 bbl. of crude per day, discharging at a maximum pressure of 800 psi. into the main line. Portland receives oil from 14 or 15 different fields in South America and Mid-Continental United States, and the crude batched through the Portland-Montreal Pipe Line has a wide range of characteristics. During the war the line carried several emergency batches of aviation gasoline but now handles only crude oils. Gravities range from 19° to 47° A.P.I., and viscosities from 34 to 1,500 S.S.U. (Cumarebo to heavy Colombian). In some instances crude with a very high wax content are blended to lower the pour point, and in other cases high-viscosity crudes are cut back with casing-head gasoline to improve their pumping characteristics. Crudes of this nature present a problem more or less peculiar to the Portland-Montreal pipe line.

The line was an adventure with low temperatures; atmospheric temperatures in some locations drop to 50° below zero in winter, and oil temperatures in the line drop to 33° above. During the winter months a maximum allowable pour point of 20° is maintained to avoid the possibility of the oil in the line going solid if there should be a forced shutdown with a resulting temperature drop in the line. Should such a catastrophe occur, it is probable that the system would be shut down until the following spring. All outside work on the line is done during the summer, as the ground is frozen solid in winter and can be broken only with a pneumatic drill or a "concrete buster."

Of the eight main-line pumping stations, six are electric and two are diesel (where electric power supply facilities are inadequate). The motors are synchronous, unity power factor motors (with the attendant economies) rated at 500 hp., 327 r.p.m., 2,300 volts. Of the diesels at the other two stations, two are 600-hp. units, and two are 500 hp. Pumps are positive-displacement, triplex double-acting plunger type. Fireproof walls with stuffing boxes for the shafts separate the pump rooms from the prime movers.

Operation of the Open System Under Manual Control

Originally, this line operated as an "open" system. A 30,000-bbl. over-and-short tank at each booster station floated on the line. An 8-in. back-pressure regulator maintained the suction pressure to the pumps at or below 20 psi. If the pumps could not handle the full throughput of a preceding station, the suction pressure

*Chief engineer, Portland Pipe Line Corp.
†Director of engineering, Mason-Neilan Regulator Co.

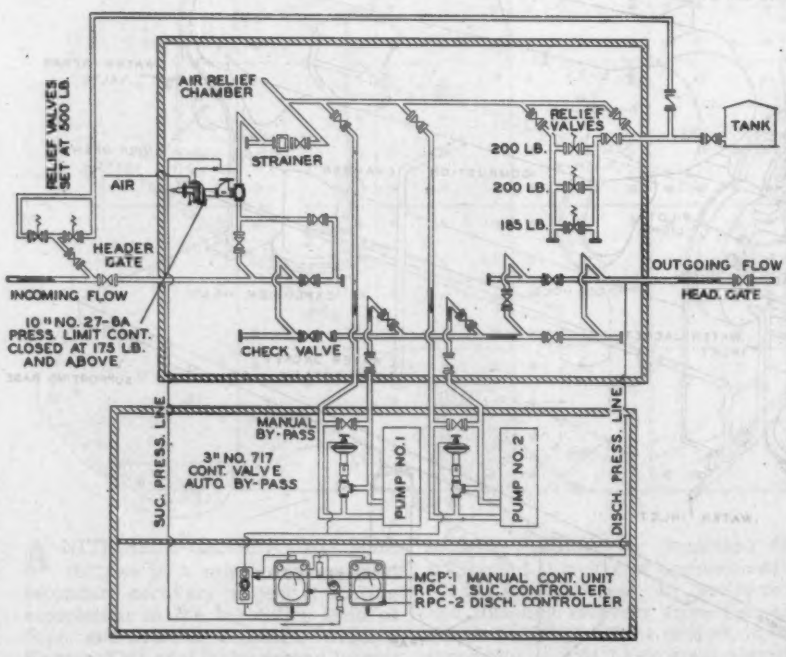


Fig. 1—Schematic layout of control system at four booster stations

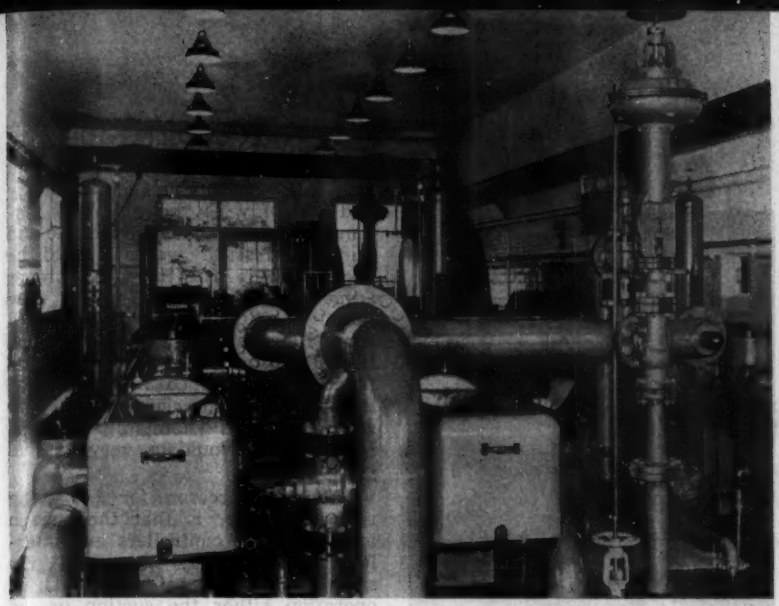


Fig. 2—Control valve in cross-over line between suction and discharge headers

would rise, partially opening the regulating valve and shunting the excess oil flow to the tank. The tank would then take oil until the regulating valve closed again, after which the contents of the tank would remain constant or would flow back through a check valve to the pump suction, if the suction pressure fell below the static tank head. The valve was large enough to route the full stream to the tank in case of station shutdown.

Operators formerly controlled station pumping rates by hand-operated plug valves on bypasses between the pump discharge and suction headers.

This manual control system required constant attention by the station operators to maintain an even pumping rate, and it was the study of this problem that led eventually to the adoption of the new control system.

First, the elevation profile of the territory through which the pipe line operates is such that between certain pump stations there are critical points, especially at the slower pumping rates. It can be seen that this condition would cause line surges and to alleviate this the station operators would adjust the pump bypass flow in order to reduce pump pounding and smooth out the pumping rate.

Second, the manual control system augmented the work of operators and dispatchers. The operator frequently had to adjust the hand-lever-operated plug valves on the pump bypasses up to a dozen times per shift as his dispatcher directed him. Every time an operator changed his bypass setting it would throw off all other stations, forcing them to readjust their pressures, and so on up and down the line. This gave the flow a long-term cycling effect. The operator had to observe his pressure records carefully and relay the data to the dispatcher, who would try to correlate the records of all stations and direct the operators accordingly. With the tanks in use the operators had to go outdoors and gage the tanks hourly even in the roughest weather.

The third problem, and probably the most serious of all, was contamination. With as many as three different tenders of varying grades in the 236-mile line at one time, the over-and-short tanks would be intermittently mixing one grade of crude with another. There was no positive way with the station tanks on the line to eliminate contamination, although by careful operation it was kept to a minimum. This condition was particularly serious with lube stock being batched through, as any contamination seriously affected the refinery operation. The remedy for this was to operate as a closed system and do away with the over-and-short tanks.

There, then, were the reasons for the changeover to automatic control: to stop contamination of the various grades of crude oils, to maintain a controlled suction pressure to the pumps, to limit the maximum discharge pressure, and to simplify the operators' and dispatchers work.

Operation Under Automatic Control

System chosen for automatically controlling the line is based on series operation of the suction and discharge controllers. This basic method has been used by a number of pipe lines, both refined products and crude, with the details of the equipment, installation and operation modified to meet local conditions.

This control system and its individual elements appear in Fig. 1.

1. Control valves.—The 3-in. angle-type air-to-close control valves are installed in crossover lines between the suction and discharge headers. There are two valves at each station, one for each pump. These provide for suction and discharge pressure control on either or both pumps.

The valve has a diaphragm motor pressure range of 3 to 15 psi. That is, the valve is open until the controller output air pressure increases to 3 psi., when it will start to close. Further pressure increase progressively closes the valve until at 15 psi. it is shut. Increased air pressure to the valve tends to close the valve, reducing the bypass flow around the pumps, increasing the flow through the station.

2. Low-limit suction-pressure control.—The measuring element of the suction controller measures the suction of the station. The predetermined control point is set at about 25 psi. or more depending on the conditions at the individual station. The output air pressure of the discharge controller is the air pressure supply to the suction controller.

Assuming that the discharge pressure is below the control point of the discharge controller (about 800 psi.), the output pressure of this controller is always the same as its air supply pressure—in effect, the discharge controller is bypassed. When the suction pressure is over 25 psi., the output air pressure of both suction and discharge controllers is 15 psi.; therefore the control valve is shut.

If the suction pressure begins to drop below 20 psi., the suction controller immediately reduces the air pressure to the 3-in. valve. This opens the valve when the air pressure is below 15 psi., thus bypassing back to suction some of the outbound oil flow.

The range of the recording and controlling pressure instrument is 0 to 250 psi., with protection for 100 per cent overload or to a total of 500 psi.

3. High-limit discharge-pressure control.—The measuring element of the discharge controller measures the discharge pressure. The predetermined control point is set at about 800 psi.

Assuming that the output air pressure from the suction pressure controller is 15 psi., the output air pressure from the discharge pressure controller is also 15 psi. as long as the station discharge pressure is below the control point of 800 psi. Therefore the valve is shut.

If the station discharge pressure begins to exceed 800 psi., the discharge controller immediately decreases its output air pressure to the control valve. This increases the bypass flow to suction, limiting the station discharge pressure to 800 psi.

4. Series operation of suction and discharge controllers.—Either the suction or discharge controller may govern the actual opening (exposed area) of the control valve, but never both at the same time. The maximum air pressure to the control valve diaphragm is 15 psi. Either controller can reduce this pressure, and the controller that establishes the lower out-

put air pressure governs the valve opening.

5. Independent nozzle air supply pressure on suction controller.—When the discharge controller comes into operation, the control mechanism of the suction controller is completely bypassed. At this time the output pressure from the discharge controller is the only supply pressure available for the pilot and nozzle. If the output from the discharge controller is below 10 psi. the nozzle and pilot operation is sluggish; below 7 psi., they are inoperative. Therefore an independent nozzle air supply of 20 psi. is brought to the suction controller.

Operation of the Control System

The major functions of the control system are to:

1. Set and maintain within limits the throughput of the initial station at Portland.
2. Adjust the individual booster station pumping capacity to the throughput of the initial station at Portland.
3. Limit the minimum booster station suction pressure (inbound).
4. Limit the maximum booster station suction pressure (inbound).
5. Limit the maximum station discharge pressure (outbound).

The originating station at Portland sets the discharge control to maintain an optimum constant discharge pressure. This determines the pipe line throughput. Under constant operating conditions a fixed discharge pressure will hold the flow constant. Variation in flow results when tenders with different viscosities are introduced. The change in flow from one tender to a second tender is gradual as the first tender becomes displaced in the line. The discharge controller gives the operator a simple means of setting the precise discharge pressure and the line throughput.

Unless operating conditions are such that there is a bottleneck at some booster station, all stations normally operate on suction control. When the suction pressure is held constant, the booster station pumps out all that comes into it. If the flow entering a station increases, the suction pressure tends to increase and the controller further throttles the valve (Fig. 2) in the bypass around the pump. This increases the station pumping capacity to match exactly again the quantity entering the station. Thus any change in throughput made at Portland causes all booster stations to adjust their pumping capacity to match. This is the only way a closed system can operate.

Holding the suction pressure to a minimum permits the line to operate at the lowest static pressure permissible with the line throughput. The suction pressure must be held to a positive value for the pump to fill properly on the suction stroke, otherwise pounding results. The suction

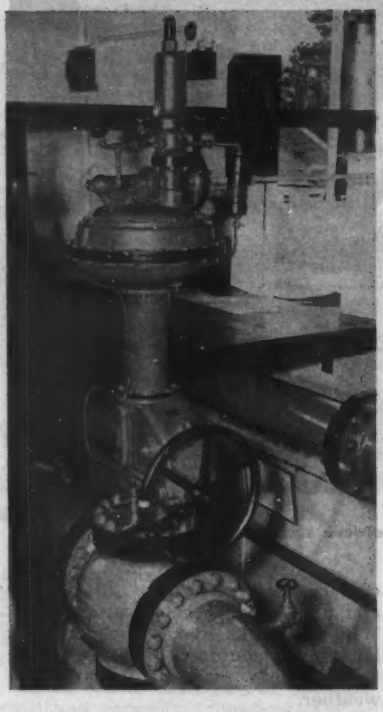


Fig. 3—Pilot-operated back-pressure regulator protects pump suction manifold

pressure at various stations is frequently set at different values, depending on the hydraulic gradient of the line entering the station.

In order to protect the pump suction manifold against high static pressure a 10-in. pilot-operated back pressure regulator (Fig. 3) functions on the suction line to the pump. This regulator is set at 175 psi. and as long as the pressure is below 175 psi. the valve is wide open. If the suction pressure tends to exceed 175 psi., the regulator closes as required to prevent further pressure increase. When the incoming line pressure exceeds 185 psi. the relief valve opens, relieving the tankage.

The discharge controller setting establishes the maximum discharge pressure. When the pressure tends to increase beyond this setting the discharge controller opens the pump bypass valve as required to limit the pressure.

Selection of Control Equipment

In selecting the type of controller to be used, the major considerations were ruggedness and simplicity. Both the suction controller and the discharge controller are "proportional controllers," without reset. The use of reset would permit a constant control point under load change where the proportional controller allows the control point setting to vary, and the setting index does not always indicate the exact control point. Reset was avoided as its disadvantages outweighed its advantages. First, it adds complication in requiring two stabilizing adjustments instead of one. As far as line operation is concerned, it is important that the controller level out the pressure and flow following any change as quickly and smoothly as the pipe-line system will permit. Rocking the line and nursing pressure waves should be avoided. It is true that with proper adjustment of reset rate (very slow rates) stability can be achieved with reset. However, with stations spotted from Portland across the border into Montreal, it seemed impractical to introduce the intricacies of reset into isolated stations where skilled instrument service would be very hard to get.

The major reason for not using reset, however, is that the suction and discharge controllers are interlocking controllers operating the same control valve (see Fig. 1). In operation either the suction or the discharge controller positions the bypass control valve. The controller that is not operating the valve is bypassed with either fully supply pressure or the diaphragm pressure equalized in the reset control system. If operating conditions then require the controllers to swing from suction to discharge control or vice versa the position of the proportional band may be at any location with respect to the setting index, and appreciable deviation in pressure may result until the reset has had time to balance out the control point. The proportional controller has the advantage that the proportional band remains fixed with respect to the setting index. Its operation is never discontinuous, which is not true of a reset controller balanced at a 20-psi. supply pressure when the control valve is fully closed at 15 psi.

The only way to vary the capacity of large constant-speed positive-displacement pumps is to bypass the flow from the discharge header to the suction header. This is a pretty tough control valve application. The required valve capacity is large and the pressure drop across the valve is appreciable. The normal discharge pressure is 600 to 800 psi. The normal suction pressure is 25 psi. The pressure drop across the valve is thus 575 to 775 psi. The control valve employed (Fig. 2) is a 3-in. angle-type valve with heat-treated stainless steel trim, hardened to a Brinell of 500 or a Rockwell C of 50. The handwheel shown on the diaphragm motor is for setting the opening of the valve manually. The 3-in. valve has a reduced area port, and is chosen to give a maximum of 25,000 bbl. per day at 600 psi. pressure drop in the full open position.

Cavitation is one of the serious problems met with when control valves operate on liquid service under high pressure drop. Excessive erosion in valve body trim and adjacent piping mark the cavitation condition, and in this case there was also a rumble and vibration with unbearable noise.

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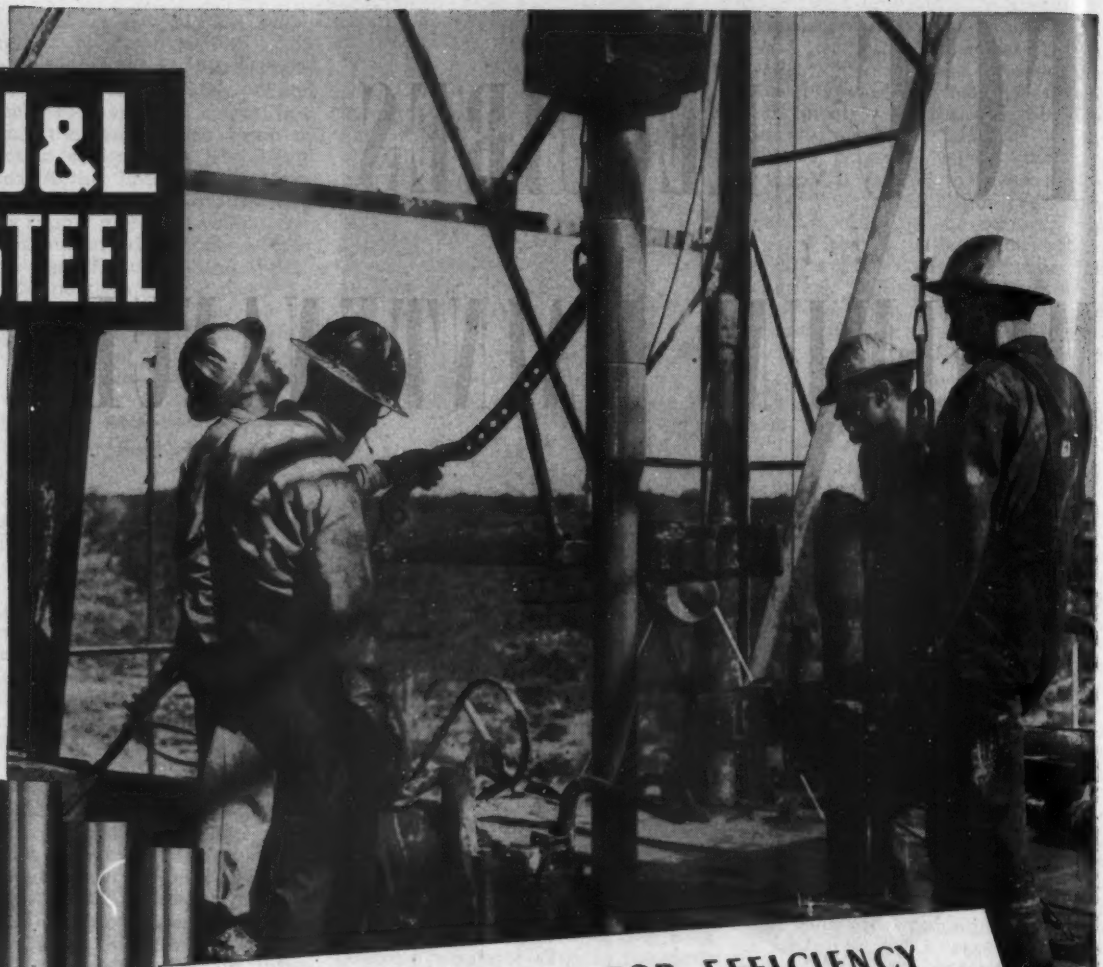

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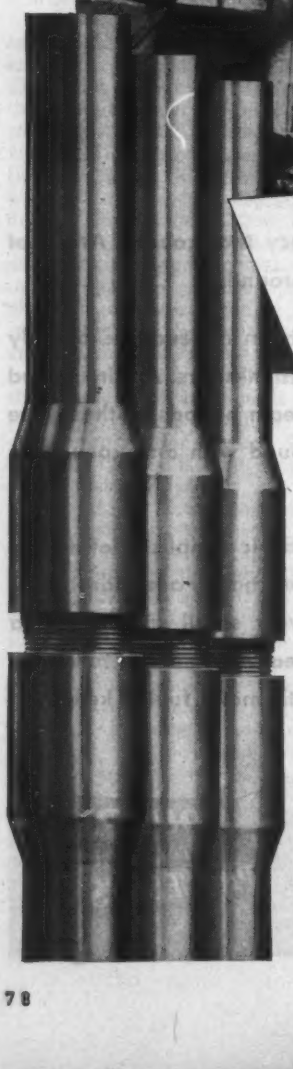

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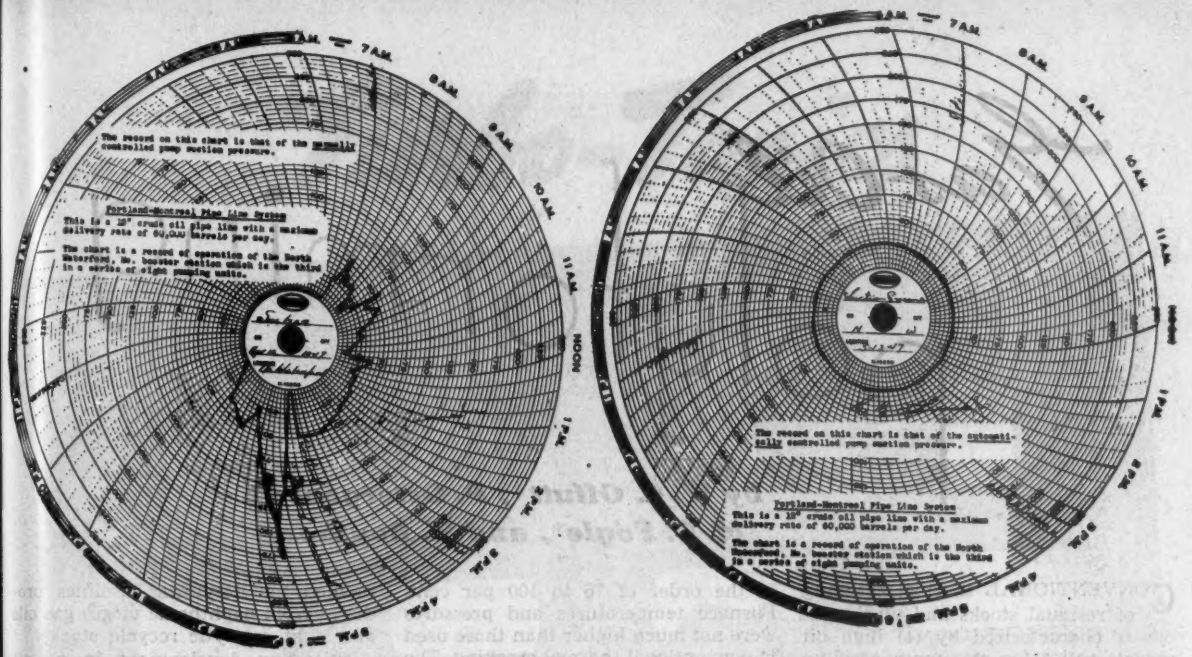
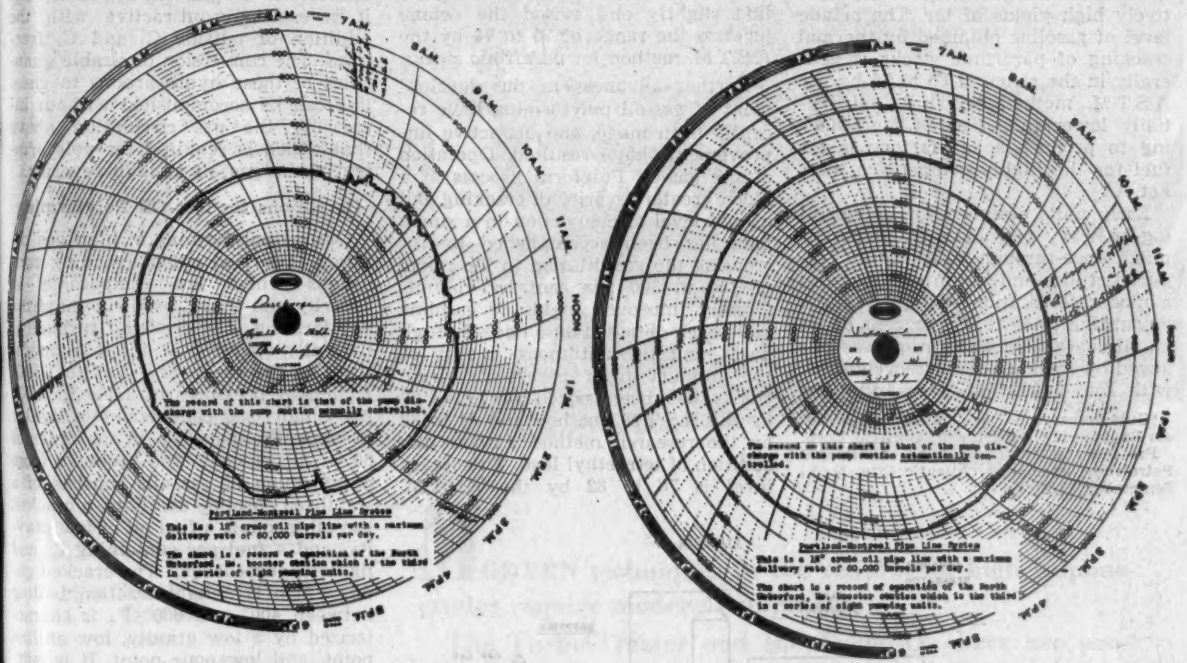


Records of suction pressures at North Waterford station. (Left) Pipe line operated as a closed system, with manual control by adjusting plug valve in bypass around the pump, based on constant observation of suction pressure. (Right) Under automatic control



Discharge pressures of the station, under manual control (left), automatic suction control (right). Discharge on automatic pressure control again reflects the general characteristics of the suction pressure, indicating smoothness in line operation (gradual increase in discharge pressure beginning at 9 a.m. is a result of a change in tender)

Extensive experimental work was done in the hydraulic laboratory and at the booster stations to determine the valve plug contours and the piping arrangement to produce a quiet and satisfactory valve for this service.

Performance Under Automatic Control

Six months of operation under automatic control show results which are most satisfactory. The dispatcher's work is now much pleasanter. His problem now is to direct the output of South Portland, the initial pumping station, so that the station of least capacity can handle the throughput while there is minimum energy loss through throttling valves in the system. To cut back on the throughput, the initial station merely resets the control point of the discharge pressure controller to a lower value, and does the same during transition from a high-viscosity to a low-viscosity tender.

With this system the over-and-short tanks will serve during scraper operation. About every 2 to 3 weeks the scraper is started through the line, and the tank at the next station goes on the line just before its calculated arrival. The tanks at the first two booster stations are connected to relief valves on the incoming line, so that in case the suction pressure exceeds 185 psi. the crude oil flows to the tanks. Should either of these stations have a shutdown, the incoming stream is bypassed to the next station, with a decrease in throughput of approximately 33 per cent. The tanks are now blocked off and serve only as insurance in case of emergency.

Gas-Oil polyforming

by W. C. Offutt*, P. Ostergaard†, M. C. Fogle*, and H. Bouther*

CONVENTIONAL thermal cracking of residual stocks and virgin gas oils is characterized by (1) high oil recycle ratios for maximum gasoline yield, (2) relatively low octane numbers of cracked gasoline, and (3) relatively high yields of tar. The octane level of gasoline obtained by thermal cracking of paraffinic stocks is generally in the range of 65 to 70 by the A.S.T.M. method, which is substantially lower than desired for blending to produce a satisfactory motor fuel for the highly competitive market.

Early units designed for polyforming of heavy petroleum fractions applied once-through cracking of reduced crudes and virgin gas oils with a moderate dilution of liquefied gas amounting to 40 to 75 per cent based on oil charge. This operation was followed by cracking of the recycle stock with somewhat higher gas dilutions of the order of 75 to 100 per cent. Furnace temperatures and pressures were not much higher than those used in conventional thermal cracking. The combination polyforming operation, however, improved the yield of gasoline slightly and raised the octane level to the range of 70 to 74 by the A.S.T.M. method for paraffinic stocks.

Further advances in the development of gas-oil polyforming have recently been made, and attractive improvements have resulted. Operation of the gas-oil Polyform process at a much greater severity of cracking and a high level of conversion in a single pass has been accomplished by increasing the gas dilution to the range of 150 to 300 per cent by volume. Greatly improved yields of gasoline have been obtained on a once-through basis, and the antiknock quality of the product from paraffinic virgin stocks has been raised to 73 to 77 by the A.S.T.M. method and 84 to 88 by the research method without the addition of tetraethyl lead. The octane level is 76 to 82 by the A.S.T.M. method for Polyform gasolines produced from naphthenic virgin gas oils and light catalytic recycle stocks.

This new development in gas-oil polyforming can be applied to the conversion of gas oil by itself, but it is especially attractive with the addition of outside C_3 and C_4 fractions. The conversion of sizable quantities of these hydrocarbons to gasoline can be accomplished without increasing the gas circulation above that which is required for polyforming of the gas oil at high severity.

*Gulf Research & Development Co. †Process Engineering Department, Gulf Oil Corp.

Presented at annual meeting of National Petroleum Association, Atlantic City, N. J., September 17-19.

Conditions for Gas-Oil Polyforming

Gas oil polyforming at high gas dilution is carried out at cracking conditions which are comparable in severity to those used in naphtha polyforming. The cracking furnace is normally operated at outlet temperatures in the range of 1,025° to 1,100° F. and at pressures of 1,000 to 2,000 psi. Single-pass conversions to lighter products are generally in the order of 60 to 70 per cent. The products from polyforming of gas oils consists of a stabilized gasoline distillate, a cracked gas-oil fraction, a fuel oil of low gravity, and a fuel gas containing C_3 and lighter hydrocarbons. The cracked gas oil, which is a light fraction boiling between 400° and 600° F., is characterized by a low gravity, low aniline point, and low pour point. It is suitable as a cutting oil for heavy residues. From a cracking standpoint, it is a very exhausted stock which, if recracked, produces a comparatively low yield of gasoline.

Fig. 1 is a simplified flow sheet for once-through gas-oil polyforming which is almost identical to naphtha polyforming in method of operation. Gas oil is charged to the top of a high-pressure absorber in which it absorbs a recycle gas consisting of small concentrations of C_2 hydrocarbons, virtually all C_3 hydrocarbons, and the butane-butene in excess of that required to maintain the desired vapor pressure of the Polyform gasoline. The rich gas oil is pumped from the base of the absorber through heat

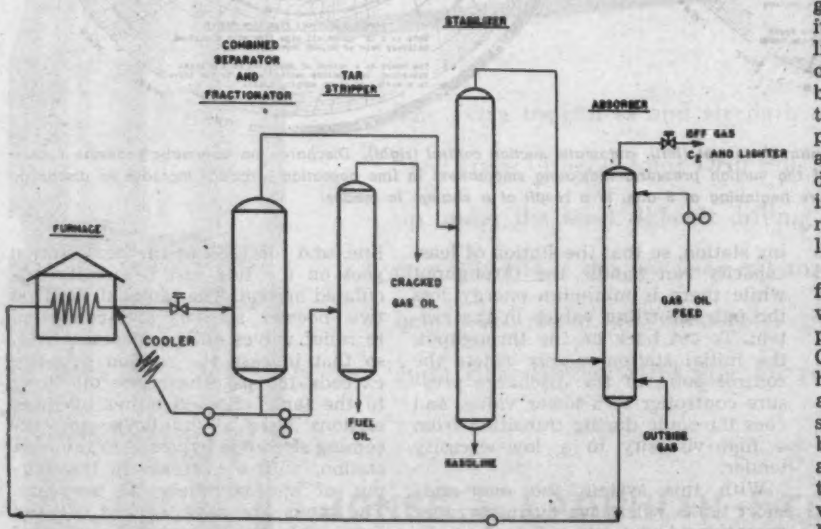


Fig. 1—A schematic flow sheet for single-pass gas-oil polyforming

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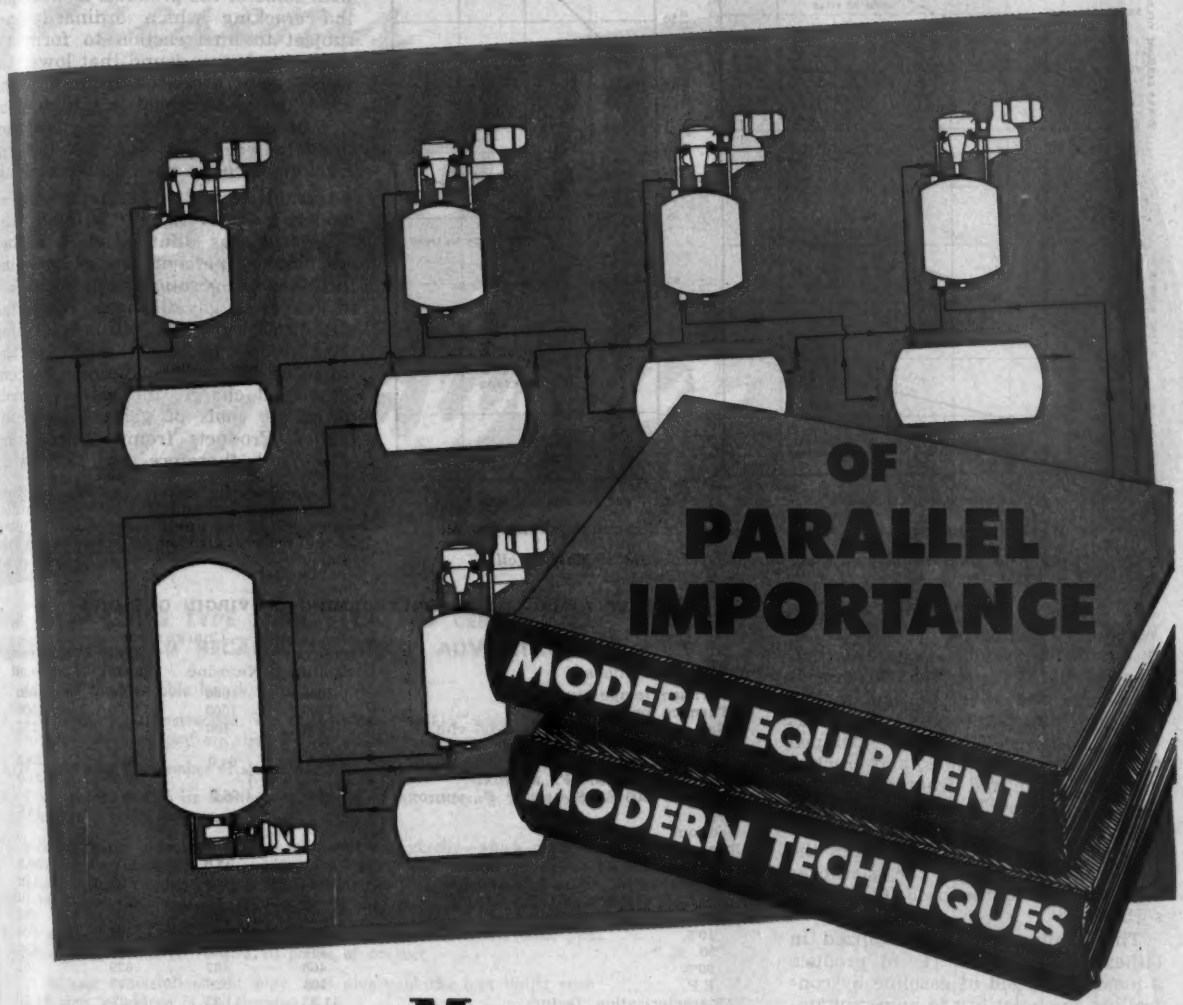

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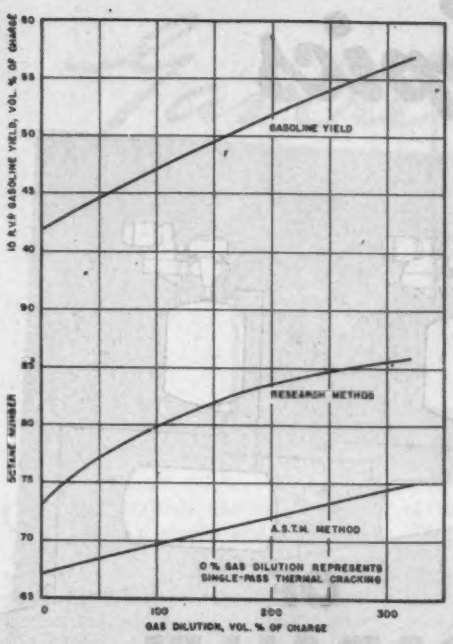
10 R.V.P. GASOLINE YIELD, VOL. % OF CHARGE
GASOLINE YIELD
RESEARCH METHOD
A.S.T.M. METHOD
OCTANE NUMBER
0 % GAS DILUTION REPRESENTS SINGLE-PASS THERMAL CRACKING
GAS DILUTION, VOL. % OF CHARGE

Fig. 2—(Left) Single-pass polyforming of a wide-boiling-range virgin gas oil

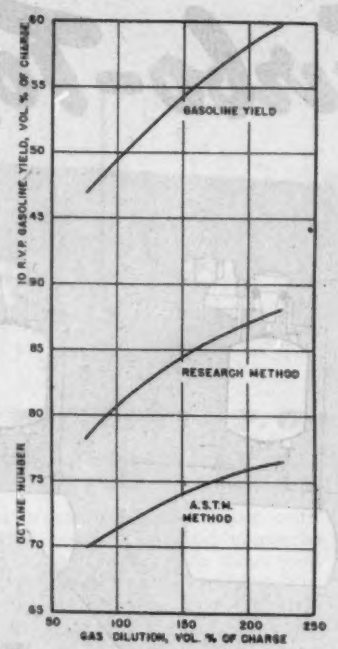

Fig. 3—(Right) Single-pass polyforming of a light virgin gas oil

exchangers to the Polyform furnace. When outside gas is charged, it usually enters the system at the absorber. The effluent from the furnace is quenched and then flashed into a separator which removes tar and gas oil as bottoms. The tar is stripped to fuel oil-specifications, and cracked gas oil is removed from the top of the tar stripper. The separator overhead passes to the stabilizer where the gasoline is stabilized, and the overhead gases from the stabilizer are passed into the base of the absorber.

The gasoline can be stabilized in either of two ways: (1) to produce a maximum yield of gasoline by controlling the volatility to approximately 10 R.v.p. and recycling excess C_4 hydrocarbons, or (2) to recover a maximum yield of butane-butene containing a high concentration of olefins in addition to debutanized gasoline. The latter method of operation is accomplished by depropanizing the gasoline in the stabilizer and recycling a minimum quantity of C_4 hydrocarbons. Essentially all of the C_3 and C_4 hydrocarbons in the overhead gases from the stabilizer are absorbed by the gas oil charge and recycled through the cracking furnace, while the C_2 and lighter gases leave the unit at the top of the absorber.

Effect of Gas Dilution

The presence of gas in the cracking furnace is the factor which permits gas-oil polyforming operations to be performed at a sufficient degree of severity to obtain high single-pass conversions and high yields of gasoline having high-octane quality. Earlier studies of gas reactions and reactions of gas with products from naphtha cracking* showed that gas (C_3 and C_4 hydrocarbons) suppressed tar and coke formation by reacting with some of the products from naphtha cracking which ordinarily are subject to interreaction to form tar and coke. It was found that lower tar yields were produced from naphtha when it was reformed in a high dilution of gas. The same types of reactions between gas and products of cracking occur in gas-oil polyforming.

Gas oils which tend to form coke at moderate conversions without the benefit of gas dilution yield higher and higher percentages of gasoline in one-pass operations when cracked in increasing gas dilutions. While the gas dilution for gas-oil polyforming on a volume per cent basis is in the range of 150 to 300 volume per cent of gas oil charge, the ratio of mols of gas to mols of gas oil is much higher. Products from the cracking of the oil, therefore, are formed in

*"Naphtha Polyforming," by W. C. Offutt, P. Ostergaard, M. C. Fogle, and H. Beuther, presented at the group session on refining of the twenty-sixth annual meeting A.P.I., 1946.

TABLE 1—SINGLE-PASS POLYFORMING OF VIRGIN GAS OILS

	Charge stock			
	Wide cut naphtha	Kerosine	Light gas oil	Wide-range gas oil
Operating conditions—				
Furnace temperature, °F.	1085	1060	1070	1050
Furnace pressure, psi.	1500	1500	1500	1500
Gas dilution, vol. % of gas-oil chg.	150	198	204	287
Yields, vol. % of gas-oil chg.—				
Gasoline (10 R.v.p.)	63.6	64.0	58.7	55.8
Gas oil (400°-600° F., approx.)	}	}	21.7	21.0
Fuel oil (200 S.F.S. at 122° F., approx.)	} 17.0	} 26.2		
	}	}	11.9	18.6
Inspections				
Charge stock				
Gravity, °A.P.I.	47.2	43.0	35.6	30.9
Aniline point, °F.	142	149	169	170
A.S.T.M. distillation, °F.				(Vacuum)
I.b.p.	222	299	420	285
10%	367	367	498	505
50 %	394	431	552	655
90%	468	487	629	861
E.P.	508	520	675	...
Characterization factor	11.93	11.85	11.87	11.91
Products				
10-R.v.p. gasoline				
Gravity, °A.P.I.	54.8	56.5	60.1	60.9
Bromine number	65	69	87	89
Aniline point, °F.	71	73	77	80
A.S.T.M. distillation, °F.				
I.b.p.	97	108	106	102
10%	135	133	124	129
50%	238	218	201	227
90%	360	355	348	368
E.P.	393	401	390	394
Octane numbers				
A.S.T.M., clear	76.3	76.3	76.0	74.4
A.S.T.M., +3 cc. T.E.L.	83.3	83.5	81.9	81.4
Research, clear	87.6	87.6	87.3	85.8
Research, +3 cc. T.E.L.	95.6	95.8	95.1	93.7
Gas oil				
Gravity, °A.P.I.	...	...	24.3	24.2
Viscosity, S.U.S. at 100° F.	...	...	35	36
Pour point, °F.	...	...	—40	—35
Aniline point, °F.	...	...	81	78
A.S.T.M. distillation, °F.				
I.b.p.	...	...	398	421
10%	...	...	472	459
50%	...	...	498	499
90%	...	...	550	570
E.P.	...	...	582	598
Fuel oil*				
Gravity, °A.P.I.	13.6	19.0	4.8	5.1
Viscosity, S.F.S. at 122° F.	...	...	195	191
Pour point, °F.	<—70	<—70	35	30

*Fuel oil plus gas oil.

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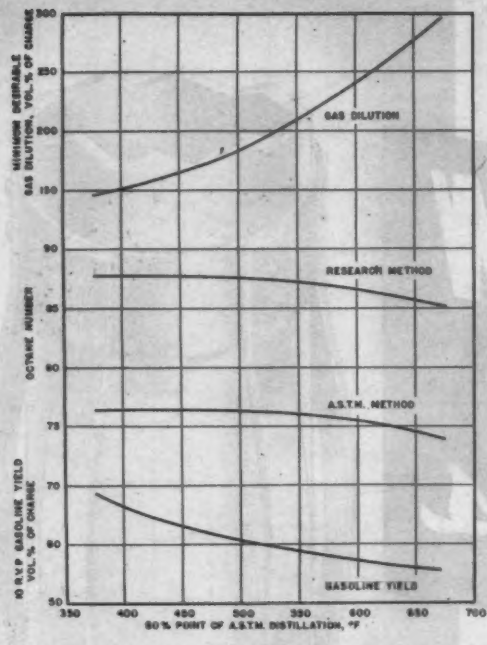

MINIMUM DESIRABLE GAS DILUTION, VOL. % OF CHARGE
GAS DILUTION
OCTANE NUMBER
RESEARCH METHOD
A.S.T.M. METHOD
10 R.V.P. GASOLINE YIELD VOL. % OF CHARGE
GASOLINE YIELD
50% POINT OF A.S.T.M. DISTILLATION, °F

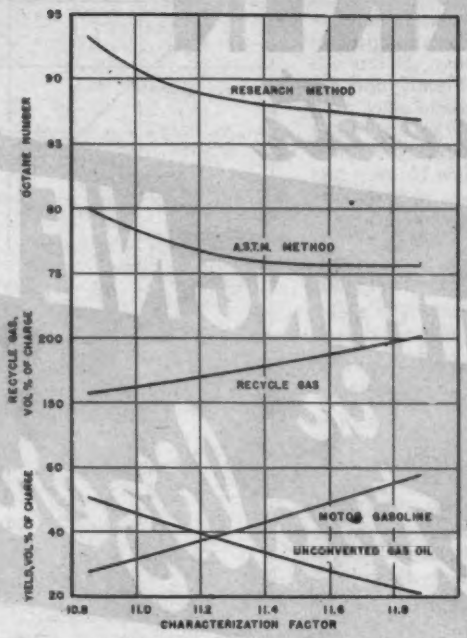


Fig. 4—(Left) Single-pass polyforming of virgin gas oils—effect of boiling range. Fig. 5—(Right) Single-pass polyforming of 400°-650° F. gas oils—effect of characterization factor

Fig. 2 is a plot of gas dilution versus octane numbers and yields for a 900° F. end-point wide boiling-range gas oil, when severity was held near the maximum level with respect to essentially coke-free operation. By increasing the gas dilution from 0 to 300 per cent, the once-through gasoline yield increased from 42 to 56 volume per cent while the A.S.T.M. octane number increased from 67 to 74.5 and the research octane number from 73.3 to 85.6.

Fig. 3 shows a similarly large increase in yield and octane number by increasing the gas

an atmosphere of reactable gas, and there is a tendency to promote thermal alkylation, thermal polymerization, and other addition-type reactions between the gas and the reactive products made from cracking of the gas oil.

If gasolines with fairly high octane numbers are desired from wide boiling-range gas oils, it is necessary to maintain a sufficient gas dilution to permit a high cracking severity compared to conventional thermal cracking. At low gas dilutions, the maximum severity of cracking (as limited by coking) is only moderate, and the results show low yields and octane numbers from single-pass operation. Cracking severities may be increased at higher gas dilutions with the result that higher conversions, better gasoline yields, and higher octane numbers are obtained.

TABLE 2 — PROPERTIES OF CYCLE STOCKS FROM SINGLE-PASS POLYFORMING OF VIRGIN GAS OILS

	Chg. stock— Light gas oil	Wide-range gas oil
Inspections of gas-oil chg.		
Gravity, °A.P.I.	35.6	30.9
Viscosity, S.U.S., at 100° F.	40	53
Pour point, °F.	15	60
Aniline point, °F.	169	170
Characterization factor	11.87	11.91
50% point, A.S.T.M. dist., °F.	552	655
Yield of cycle stock, vol. % of chg.	21.7	21.0
Inspections of cycle stock		
Gravity, °A.P.I.	34.3	34.2
Viscosity, S.U.S. at 100° F.	35	36
Aniline point, °F.	81	78
Characterization factor	10.9	10.9
A.S.T.M. dist., °F.		
I.b.p.	398	421
10%	472	459
50%	496	499
90%	550	570
E.P.	582	606

TABLE 3—SINGLE-PASS POLYFORMING OF VIRGIN GAS OILS WITH AND WITHOUT OUTSIDE GAS

	Charge stock— Light gas oil—			Wide-range gas oil—		
Outside gas charge	None	Propane-propylene	Butane-butene	None	Propane-propylene	N-Butane
Unsaturates, vol. %	...	60	50	...	60	0
Operating conditions						
Furnace outlet temp., °F.	1070	1070	1070	1050	1060	1040
Furnace pres., psi.	1500	1500	1500	1500	1500	1500
Gas dilution, vol. % gas-oil chg.	204	295	294	287	303	310
Outside gas, vol. % gas-oil chg.	0	20	18	0	17	21
Yields, vol. % of gas-oil chg.						
Gasoline (10 R.v.p.)	58.7	67.2	67.5	55.8	67.1	63.2
Gas oil (400-600° F., approx.)	21.7	19.6	21.0	21.0	19.7	22.8
Fuel oil (200 S.F.S. at 122° F., ap.)	11.9	13.7	13.8	18.6	17.4	20.5
Inspections						
Charge stock						
Gravity, °A.P.I.	35.6	35.6	34.3	30.9	32.7	30.9
Aniline point, °F.	169	169	172	170	171	170
A.S.T.M. dist., °F				(Vacuum)	(Vacuum)	(Vacuum)
I.b.p.	420	420	423	285	300	285
10%	498	498	510	505	516	505
50%	552	552	565	655	641	655
90%	629	629	639	861	773	861
E.P.	675	675	736	...	...	...
Characterization factor	11.87	11.87	11.86	11.91	11.97	11.91
Products						
10 R.v.p. gasoline						
Gravity, °A.P.I.	60.1	60.5	59.3	60.9	62.0	61.9
Bromine number	87	...	93	89	83	62
Aniline point, °F.	77	85	74	80	85	90
A.S.T.M. dist., °F.						
I.b.p.	106	98	106	102	92	101
10%	124	134	130	129	115	129
50%	201	204	205	227	197	200
90%	348	336	357	368	356	339
E.P.	390	394	410	394	400	399
Octane numbers						
A.S.T.M., clear	76.0	75.5	75.8	74.4	74.2	74.6
A.S.T.M., +3 cc. T.E.L.	81.9	83.2	82.4	81.4	...	82.4
Research, clear	87.3	86.1	89.0	85.8	85.2	84.4
Research, +3 cc. T.E. L.	95.1	95.1	96.6	93.7	93.6	93.4
Gas oil						
Gravity, °A.P.I.	24.3	21.3	22.6	24.2	23.6	24.2
Viscosity, S.U.S. at 100° F.	35	36	37	36	37	36
Pour point, °F.	—40	—40	—60	—35	—35	—30
Aniline point, °F.	81	...	82	78	83	89
A.S.T.M. dist., °F.						
I.b.p.	398	444	470	421	456	437
10%	472	472	494	459	490	464
50%	496	523	518	499	520	510
90%	550	640	568	570	590	578
E.P.	582	685	610	598	638	623
Fuel oil						
Gravity, °A.P.I.	4.8	...	5.6	5.1	5.1	5.6
Viscosity, S.F.S. at 122° F.	195	...	187	191	169	171
Pour point, °F.	35	...	30	30	25	30

dilution when a light gas oil was polyformed. In this case, a narrower range of gas dilutions was covered (75 to 200 volume per cent). It can be seen for both stocks that there is a minimum gas dilution for satisfactory operation at a given octane level.

The maximum gas dilution that can be obtained without the use of outside gases depends upon the boiling range and characterization factor of the stock. Wide boiling-range virgin gas oils produce a sufficient quantity of C_3 hydrocarbons in the cracking process to allow a maximum gas dilution of approximately 300 volume per cent. Light virgin gas oils and light catalytic cycle stocks produce only enough recycle gas to permit a maximum of about 200 per cent gas dilution. Some very refractory cycle stocks make even less gas, and the maximum gas dilution obtainable with no outside gas is 150 to 175 volume per cent. In all cases, the gas dilution can be raised by the addition of outside gas, or the gas dilution can be lowered by adjusting the operation of the absorber. The principal requirement is that the gas dilutions be high enough to obtain the desired cracking severity, conversion, or octane level without the excessive formation of coke.

Effect of Boiling Range

Single-pass polyforming of paraffinic virgin gas oils produces high yields of gasoline with A.S.T.M. clear octane numbers in the range of 74 to 77, and research octane numbers in the range of 85 to 88. Naphthenic virgin gas oils produce gasolines with still higher octane numbers, but with slightly lower yields. Yields, octane numbers, and circulations differ with boiling range of the charge. Table 1 shows results from single-pass polyforming of several boiling-range virgin stocks from paraffinic crude sources.

This table indicates the extent to which yields and octane numbers are functions of the boiling range of the charge stock. The gas circulation was set at approximately the minimum to permit a sufficiently severe operation for the production of a high-octane gasoline. Fig. 4 illustrates graphically the effect of the 50 per cent point of the gas oil charge on yields, octane numbers, and minimum desirable gas circulation for gas oils with a characterization factor of about 11.9. Lighter gas oils produce more gasoline with higher octane numbers and require lower gas circulations than heavier charge stocks. Heavy distillate oils can be polyformed satisfactorily, although the maximum octane number is limited on heavy stocks.

The unconverted oil or cycle stock is similar to cycle stocks obtained from catalytic cracking. The yield and quality of the cycle stock produced from single-pass polyforming do not vary greatly with boiling range of the charge. The cycle stock produced depends more upon the character of the charge and polyforming severity rather than the boiling range of the charge. Table 2 shows yields and properties of cycle stocks from the polyforming of light and wide boiling-range gas oils. These oils are excellent cutting oils for heavy residues. They are poor cracking stocks, which when cracked thermally, produce a low yield of high-octane gasoline.

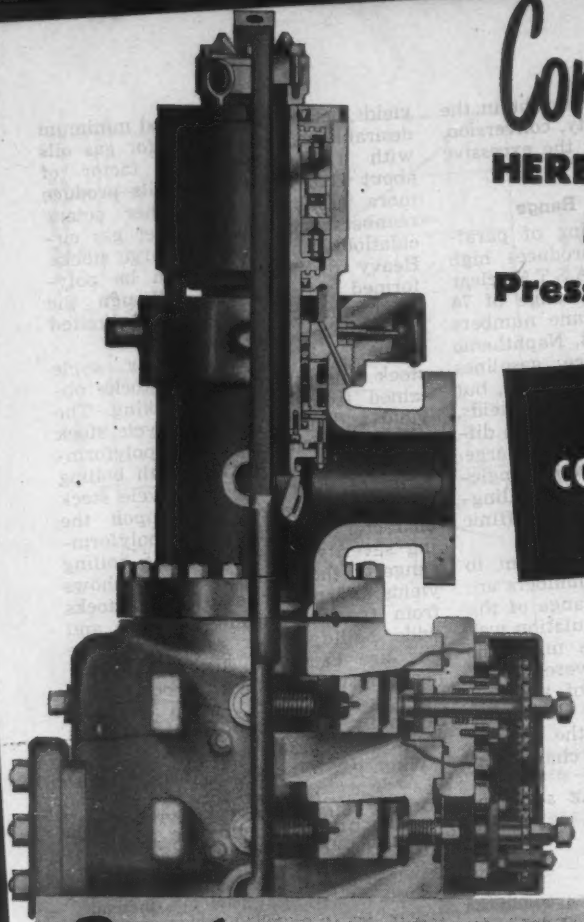
When gas oils are polyformed with

TABLE 4—COMPARISON OF MAXIMUM BUTANE-BUTENE PRODUCTION WITH MAXIMUM GASOLINE PRODUCTION FOR SINGLE-PASS POLYFORMING OF A LIGHT VIRGIN GAS OIL

Operating conditions	Maximum gasoline	Maximum butane-butene
Furnace outlet temp., °F.	1070	1070
Furnace pressure, psi.	1500	1500
Gas dilution, vol. % of gas-oil chg.	204	202
Outside propane, vol. % of gas-oil chg.	0	6
Yields, vol. % of gas-oil chg.		
Gasoline (10 R.v.p.)	58.7	55.0
Excess butane-butene	1.3	10.0
Total butane-butene	5.4	13.6
Gas oil (400°-600° F., approx.)	21.7	19.5
Fuel oil (200 S.F.S. at 122° F., approx.)	11.9	12.0
Inspections		
Charge stock		
Gravity, °A.P.I.	35.6	34.3
Aniline point, °F.	169	172
A.S.T.M. dist., °F.		
I.b.p.	420	423
10%	496	510
50%	552	565
90%	629	689
E.P.	675	736
Characterization factor	11.87	11.86
Products		
10 R.v.p. gasoline		
Gravity, °A.P.I.	60.1	57.3
Bromine number	87	76
Aniline point, °F.	77	72
A.S.T.M. dist. °F.		
I.b.p.	106	102
10%	124	135
50%	201	210
90%	348	340
E.P.	390	396
Octane numbers		
A.S.T.M., clear	76.0	75.8
A.S.T.M., +3 cc. T.E.L.	81.9	83.8
Research, clear	87.3	88.4
Research, +3 cc. T.E.L.	95.1	96.6
Gas oil		
Gravity, °A.P.I.	24.3	22.0
Viscosity, S.U.S. at 100° F.	35	37
Pour point, °F.	—40	—45
Aniline point, °F.	81	73
A.S.T.M. dist., °F.		
I.b.p.	398	461
10%	472	489
50%	498	511
90%	550	568
E.P.	582	630
Fuel oil		
Gravity, °A.P.I.	4.8	5.7
Viscosity, S.F.S. at 122° F.	195	195
Pour point, °F.	35	35

TABLE 5—COMPARISON OF SINGLE-PASS POLYFORMING OF A LIGHT GAS OIL WITH RECYCLE THERMAL CRACKING

Operating conditions	Single-pass polyforming	Recycle thermal cracking
Furnace outlet temp., °F.	1,070	1,009
Furnace pressure, psi.	1,500	750
Gas dilution, vol. % of gas-oil chg.	204	....
Recycle oil, vol. % of gas oil chg.	....	215
Yields, vol. % gas-oil charge		
Gasoline (10 R.v.p.)	58.7	57.7
Gas oil (400°-600° F. approx.)	21.7	....
Fuel oil (200 S.F.S. at 122° F., approx.)	11.9	24.4
Inspections		
Charge stock		
Gravity, °A.P.I.	35.6	34.3
Aniline point, °F.	169	172
A.S.T.M. distillation, °F.		
I.b.p.	420	423
10%	496	510
50%	552	565
90%	629	689
E.P.	675	736
Characterization factor	11.87	11.86
Products		
10 R.v.p. gasoline		
Gravity, °A.P.I.	60.1	58.3
Bromine number	87	76
Aniline point, °F.	77	85
A.S.T.M. distillation, °F.		
I.b.p.	106	92
10%	124	143
50%	201	238
90%	348	358
E.P.	390	411
Octane numbers		
A.S.T.M., clear	76.0	71.8
A.S.T.M., +3 cc. TEL	81.9	81.4
Research, clear	87.3	81.9
Research, +3 cc. TEL	95.1	92.0
Gas oil		
Gravity, °A.P.I.	24.3	....
Viscosity, S.U.S. at 100° F.	35	....
Aniline point, °F.	81	....
A.S.T.M. distillation, °F.		
I.b.p.	398	....
10%	472	....
50%	498	....
90%	550	....
E.P.	582	....
Fuel oil		
Gravity, °A.P.I.	4.8	6.1
Viscosity, S.F.S. at 122° F.	195	84
Pour point, °F.	35	45
B.s. and w., %	0.5	0.5



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In addition, the design of the unit is such that increased well pressure only assists in sealing the stripper rubber more tightly against the drill string. The higher the pressure the tighter the seal—*automatically!*

Point 2. **ANY SHAPE:** The Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper not only maintains a continuous pressure-tight seal, but also expands and contracts *automatically* to fit various shapes and diameters in the drill string. It seals around the square sides of a kelly as efficiently as the round drill pipe—and hexagon or octagon shapes as well. And (excepting such abnormally large diameters as reamers and bits) even varying diameters such as tool joints, upsets, couplings, etc., strip through the unit without losing the pressure-tight seal.

Point 3. **NEGLIGIBLE WEAR:** Because the stripper unit rotates *with* the kelly—not around it—wear on the stripper rubber is reduced to an absolute minimum. Also, this feature assists in maintaining a tighter seal because the seal around the kelly is not subjected to continuous flexing or change of sealing contact as the string rotates.

Point 4. **TROUBLE-FREE BEARINGS:** In the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper the bearing assembly upon which the unit rotates is specially engineered to withstand the severe impact and rotational loads of modern high speed drilling. Separate bearings carry the thrust and radial loads, and radial bearings are separated to give maximum resisting moment against stresses induced by an off-center wobble in the kelly. All bearings are lifetime prepacked with heat-resisting lubricant, further minimizing maintenance and assuring maximum trouble-free performance.

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no outside gas, the gas dilution necessary for severe cracking of the gas oil consists of gases made from cracking of the oil. As the gas dilution is increased, more complete retention of C_3 hydrocarbons in the recycle gas is obtained, and the gas recycle stream becomes more lean in olefin. The amount of gas that is converted each pass decreases, and the conversion per pass of gas to gasoline is relatively small. When outside gases such as olefinic C_3 fractions or butane-butene are charged, the circulating gas becomes more olefinic and less refractory and thus serves two functions: (1) to permit high cracking severities on the gas oil and (2) to utilize the required gas dilution to produce attractive yields of gasoline from extraneous gas. In some cases, as much as 25 per cent of olefinic outside gas based on oil charge can be converted with no increase in gas circulation. In a situation of this type, the additional cost of processing the gas is very low.

There are some situations where small increases in gas dilution are necessary if it is desired to convert a given amount of outside gas. Table 3 shows examples of single-pass polyforming of a wide boiling range and a light virgin gas oil in a self-contained operation and with various types of outside gases for comparison. In one case where 17 volume per cent of outside propane-propylene containing 60 per cent of olefin was charged with a wide boiling-range gas oil, an increase in gasoline yield of 11.3 per cent was obtained. The additional yield of gasoline, amounting to 66.5 volume per cent of the gas charge, was realized with no increase in gas circulation. When 21 volume per cent of n-butane was charged as outside gas, a yield of 35 volume per cent of gasoline was obtained from the gas with no increase in gas circulation.

Fig. 6—Single-pass polyforming of light gas oils—gasoline yield from outside gas versus characterization factor

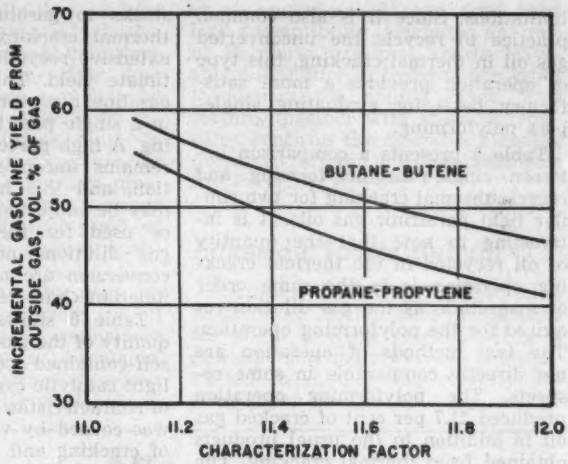

TABLE 3—SINGLE-PASS POLYFORMING OF LIGHT CATALYTIC CYCLE STOCKS

	Type of charge to catalytic unit		
Operating conditions (Polyform unit)	Paraffinic	Intermediate	Naphthenic
Furnace temp., °F.	1,070	1,060	1,070
Furnace pressure, psi.	1,500	1,500	1,500
Gas dilution, vol. % gas oil chg.	183	166	160
Yields, vol. % gas-oil chg.			
Gasoline (10 R.v.p.)	43.0	36.7	27.0
Gas oil (400°-600° F., approx.)	33.2	41.3	53.0
Fuel oil (200 S.F.S. at 122° F., approx.)	14.9	15.0	10.4
Inspections			
Polyform charge stock			
Gravity, °A.P.I.	30.9	28.0	23.9
Aniline point, °F.	133	110	96
A.S.T.M. distillation, °F.			
I.b.p.	430	393	451
10%	482	461	477
50%	525	517	503
90%	602	581	555
E.P.	657	625	630
Characterization factor	11.44	11.18	10.86
Products			
10 R.v.p. gasoline			
Gravity, °A.P.I.	61.0	58.5	....
Bromine number	94	62	....
Aniline point, °F.	75	73	....
A.S.T.M. distillation, °F.			
I.b.p.	98	90	....
10%	120	121	....
50%	203	211	....
90%	350	360	....
E.P.	397	401	....
Octane numbers			
A.S.T.M., clear	76.2	75.9	79.9
A.S.T.M., +3 cc. TEL	83.0	82.7	85.8
Research, clear	88.0	86.9	93.2
Research, +3 cc. TEL	95.8	94.6	99.5
Gas oil			
Gravity, °A.P.I.	20.3	17.2	....
Viscosity, S.U.S. at 100° F.	35	35	....
Pour point, °F.	—40	—30	....
Aniline point, °F.	101	86	....
A.S.T.M. distillation, °F.			
I.b.p.	441	445	....
10%	466	474	....
50%	501	507	....
90%	556	564	....
E.P.	619	601	....
Fuel oil			
Gravity, °A.P.I.	1.2	0.9	....
Viscosity, S.F.S. at 122° F.	85	198	....
Pour point, °F.	30	40	....
B.s. and w., %	Trace	0.1	....

For stocks ordinarily requiring low gas dilutions, it is generally necessary to increase the circulation in order to convert an appreciable amount of outside gas. When polyforming a light virgin gas oil (440° to 700° F.) which generally requires a gas dilution of about 200 per cent, the gas circulation must be increased to about 275 per cent to convert 20 to 25 per cent of outside propane-propylene, outside butane-butene, or outside n-butane. Twenty per cent of propane-propylene containing 60 per cent of olefin increased the gasoline yield from 58.7 to 67.2. The increase in gasoline yield was 42.5 volume per cent based on the outside gas. Similar yields were obtained from butane-butene.

Operation of the gas-oil Polyform unit can be varied to compensate from changing butane requirements in the refinery. When excess butane-butene is available, it can be used as an outside gas charge to the Polyform unit and converted to gasoline. If the rest of the refinery has a good butane balance, the Polyform unit can be operated to produce only enough butane for vapor-pressure requirements of the gasoline. However, the Polyform unit can also be used to produce excess butane-butene when there is an over-all efficiency of butane in the refinery. This latter type of operation requires only a change in the method of operating the stabilizer.

Table 4 shows a typical operation for the production of maximum butane-butene from a light virgin gas oil compared to normal operation for gasoline having a 10 R.v.p. Since essentially all of the butane-butene was removed from the gas recycle stream in the operation for maximum butane-butene production, it was necessary to charge 6 per cent of outside propane to maintain the desired gas dilution. This operation produced a yield of 10 per cent of excess butane-butene containing 52 per cent of unsaturates, and there was a decrease of 3.7 per cent in the yield of 10-R.v.p. motor gasoline. A total yield of gasoline plus butane-butene of 60.0 per cent was obtained in the operation for maximum gasoline production, while a yield of 65.0 per cent was obtained when operating for maximum butane-butene production with 6 per cent outside propane.

Comparison of Single-Pass Polyforming With Recycle Thermal Cracking

Single-pass polyforming was compared with single-pass thermal cracking of the same stock in Fig. 2 (0 per cent gas dilution representing thermal cracking). This was not a desirable comparison of the two processes because it was necessary to conduct the thermal cracking operations at a low degree of conversion due to coking

limitations. Since it is also common practice to recycle the unconverted gas oil in thermal cracking, this type of operation provides a more satisfactory basis for evaluating single-pass polyforming.

Table 5 presents a comparison between single-pass polyforming and recycle thermal cracking for two similar light paraffinic gas oils. It is interesting to note that the quantity of oil recycled in the thermal cracking operation is in the same order of magnitude as the gas dilution required for the polyforming operation. The two methods of operation are not directly comparable in some respects. The polyforming operation produced 21.7 per cent of cracked gas oil in addition to the usual products obtained from thermal cracking. The recycle thermal cracking operation made 7.5 per cent of excess butane-butene and 13.0 per cent of a C_3 fraction which was relatively low in olefin content. Although these basic differences exist in the byproducts from the two processes, the yields of gasoline are almost identical.

The principal advantage of the polyforming operation is in the quality of the gasoline. The unleaded A.S.T.M. and research octane numbers of the Polyform distillate are 76.0 and 87.3, compared to 71.8 and 81.9 for the distillate from conventional thermal cracking. Additional advantage may be gained from the unconverted gas oil which can be recycled for further gasoline production or used as a cutting oil for blending with viscous residual stocks. This comparison at about the same yield of gasoline indicates that gas oil polyforming permits a substantially higher recovery of liquid products than the recycle thermal cracking operation.

The comparison shown in Table 5 involved a self-contained polyforming operation without outside gas charge. It has been previously mentioned that gas oil polyforming operations may be greatly enhanced by charging extraneous refinery gas streams with little or no additional processing cost. In this manner, further advantages with respect to gasoline production can be gained from the polyforming operation.

Polyforming of Catalytic Cycle Stocks

The increasing quantities of catalytic cycle stocks available for processing or handling in the modern refinery accentuates the importance of an efficient means of converting these stocks to high-quality gasoline. The refractory nature of light catalytic cycle stocks makes recycling within the catalytic cracking unit, in most cases, an unadvisable operation, especially in a refinery where catalytic cracking capacity is limited or sufficient charge is available from virgin sources. Conversion of cycle stocks to gasoline by conventional thermal cracking processes requires extensive recycling of gas oil for ultimate yield. This ultimate yield of gasoline, however, may be approached in a single pass by gas oil polyforming. A high percentage of gas oil also remains unconverted in this operation, and this highly refractory oil may be subjected to further cracking or used for fuel-oil blending. The gas dilutions necessary for severe conversion are moderate due to the inherent characteristics of the stocks.

Table 6 shows yields and octane quality of the gasolines obtained from self-contained polyforming of three light catalytic cycle stocks. The range of characteristics of these three stocks was caused by variations in severity of cracking and charge properties of the catalytic operations from which they were produced. The yields of gasoline and unconverted gas oil from the polyforming operations are very sensitive to the character of the cycle stock charged. There is also a substantial increase in octane numbers of the gasoline produced from the most refractory gas oil.

Fig. 5 pictures graphically the effect of characterization factor of the charge on yields of gasoline and unconverted gas oil, gas dilution, and octane numbers of distillate produced from single-pass polyforming of light catalytic cycle stocks. The curves were extended to a polyforming operation on a light virgin gas oil at the end of the scale representing high characterization factors. The operation on the virgin gas oil falls directly in line with those made on the catalytic cycle stocks.

Polyforming of Catalytic Cycle Stocks With Outside Gas

Extraneous C_3 and C_4 fractions derived from catalytic cracking or other refinery operations can be converted advantageously to gasoline in conjunction with polyforming of light catalytic cycle stocks. Since the gas dilution for self-contained polyforming of catalytic gas oils is normally in the range of 150 to 185 volume per

TABLE 7—SINGLE-PASS POLYFORMING OF LIGHT CATALYTIC CYCLE STOCKS WITH OUTSIDE GASES

	Type of charge to catalytic unit						
	Paraffinic			Intermediate			
Outside gas charge	None	Propane-propylene	Butane-butene	None	Propane-propylene	n-Butane	Butane-butene
Unsaturates, vol. %	....	60	50	....	60	0	50
Operating conditions (Polyform unit)							
Furnace outlet temp., °F.	1,070	1,070	1,070	1,060	1,070	1,070	1,080
Furnace pressure, psi.	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Gas dilution, vol. % gas-oil chg.	183	303	298	166	295	301	296
Outside gas, vol. % gas-oil chg.	0	25	20	0	25	25	20
Yields, vol. % gas-oil chg.							
Gasoline (10 R.v.p.)	43.0	55.1	57.3	36.7	50.2	46.7	48.0
Gas oil (400°-600° F., approx.)	33.2	35.6	35.1	41.3	37.6	43.2	35.8
Fuel oil (200 S.F.S. at 122° F. approx.)	14.9	15.1	13.2	15.0	17.0	14.5	17.6
Inspections							
Charge stock							
Gravity, °A.P.I.	30.9	30.9	30.9	28.0	28.0	28.0	28.0
Aniline point, °F.	133	133	133	110	110	110	110
A.S.T.M. distillation, °F.							
I.b.p.	430	430	430	393	393	393	393
10%	482	482	482	461	461	461	461
50%	525	525	525	517	517	517	517
90%	602	602	602	581	581	581	581
E.P.	657	657	657	625	625	625	625
Characterization factor	11.44	11.44	11.44	11.18	11.18	11.18	11.18
Products							
10 R.v.p. gasoline							
Gravity, °A.P.I.	61.0	61.2	60.5	58.5	60.5	63.6	58.4
Bromine number	94	78	88	62	77	70	69
Aniline point, °F.	75	80	79	73	75	83	70
A.S.T.M. distillation, °F.							
I.b.p.	98	91	92	90	94	96	97
10%	120	117	117	121	117	111	124
50%	203	192	193	211	188	193	202
90%	350	342	348	360	359	358	367
E.P.	397	399	400	401	400	396	402
Octane numbers							
A.S.T.M., clear	76.2	76.0	76.2	75.9	77.1	76.5	77.5
A.S.T.M., +3 cc. TEL	83.0	84.1	83.3	82.7	83.7	84.1	84.3
Research, clear	88.0	87.2	87.9	86.9	88.2	88.1	90.3
Research, +3 cc. TEL	95.8	95.2	95.8	94.6	96.0	95.5	97.1
Gas oil							
Gravity, °A.P.I.	20.3	19.6	19.3	17.2	17.1	18.0	14.9
Viscosity, S.U.S. at 100° F.	35	36	36	35	35	35	35
Pour point, °F.	—40	—45	—40	—30	—65	—50	<—70
Aniline point, °F.	101	....	101	86	86	87	74
A.S.T.M. distillation, °F.							
I.b.p.	441	441	456	445	....	350	454
10%	466	473	482	474	470	467	475
50%	501	508	511	507	500	508	506
90%	556	569	577	564	548	570	569
E.P.	619	636	651	601	605	637	636
Fuel oil							
Gravity, °A.P.I.	1.2	1.1	1.4	0.9	—0.2	1.0	—0.9
Viscosity, S.F.S. at 122° F.	85	188	291	196	196	183	187
Pour point, °F.	30	30	50	40	40	40	45

cent, it is often desirable to increase the gas circulation for operations charging substantial amounts of outside gas. Increasing the amount of gas dilution in this type of operation is optional, however, but less extensive conversion of the outside gas may be expected when the total gas circulation is limited.

Table 7 shows yields and octane numbers of the distillate from polyforming of two light catalytic cycle stocks with outside normal butane and olefinic C_3 and C_4 fractions from catalytic cracking. Increased gas circulations in the range of 270 to 280 volume per cent were used in order to convert 20 to 25 per cent (based on oil charge) of the various outside gas streams. The data indicate that approximately 4 to 5 passes were necessary to convert the outside gas completely.

Incremental yields of gasoline resulting from conversion of the extraneous gas were calculated to be 45 to 60 volume per cent, based on outside gas for the various operations. Fig. 6 shows a plot of incremental yields of gasoline as a function of characterization factor of the gas oil charged to the Polyform unit. This plot was constructed from data for the two light catalytic cycle stocks and a light virgin gas oil from a paraffinic crude. Although incremental yields are subject to considerable error due to the manner in which they must be calculated, there are certain trends which seem to apply. Outside butane-butene produces somewhat higher yields of gasoline with each gas oil than those obtained from an olefinic C_3 fraction. It also appears that higher incremental yields are realized from either gas fraction when gas oils having lower characterization factors are polyformed.

Conclusion

The extreme degree of cracking severity which it is possible to attain in a polyforming furnace makes the Polyform process a highly desirable means of converting refractory catalytic gas oils to gasoline. The severe cracking is accomplished by means of a moderately high gas dilution which can also be utilized as the necessary circulation for converting partially or completely the gaseous by-products from catalytic cracking operations. Attractive yields of gasoline are obtained from the extraneous gas, as well as from the gas oil charged.

Polyforming also offers many important advantages in gasoline production for the processing of crude fractions which are least desirable as charge stocks for catalytic cracking. Straightrun gasoline, naphthas, and light virgin gas oils are readily converted to high yields of quality blending components for motor gasoline. A wide degree of flexibility of operation can be maintained since the equipment and range of processing variables are essentially the same for all of the various types of charge. Compensations for seasonal variations in the requirements for light fuel oils and butane-butene can also be made by simple adjustments in the operation of the Polyform unit. In this manner, the Polyform process can serve as a complementary process with catalytic cracking as a means for attaining the ultimate yield of quality gasoline from a given quantity of crude.

The high level of the laboratory octane ratings of gasolines from gas oil polyforming has been emphasized throughout the foregoing discussion. Road performance of these gasolines also indicates especially good quality at all engine speeds and good road lead susceptibility. Chemical analysis of Polyform gasolines shows favorable distribution of hydrocarbon types throughout the boiling range. This feature, together with balanced volatility, confirms the desirable blending properties offered by distillates from the Polyform process.

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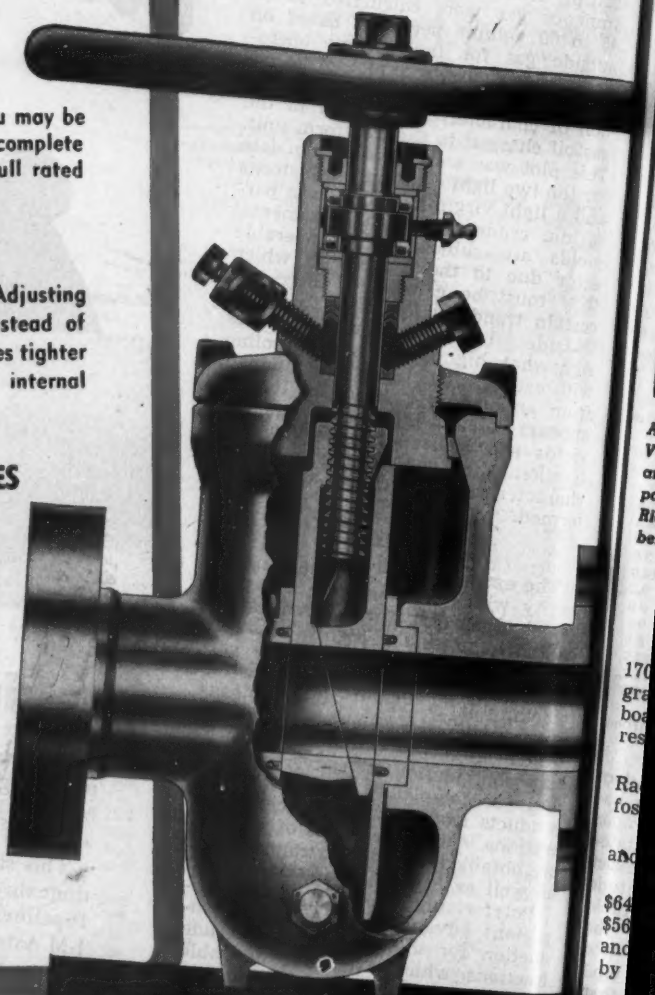

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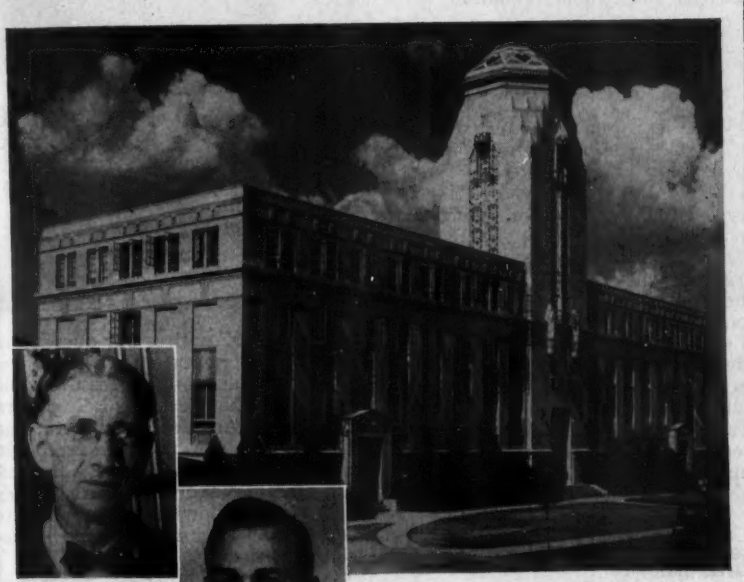

Above: Harold Vance, professor and head of department
Right: Prof. Albert B. Stevens

Petroleum Engineering Building at Texas Agricultural and Mechanical College, where 17 specialized undergraduate petroleum courses are offered

SALIENT FACTS AND FIGURES

General.—Located at College Station, 100 miles north of Houston and 170 miles south of Dallas. Established by state legislature in 1871. Land grant school for men, state-controlled and supported. Administered by board of nine directors appointed by governor. All students live in school residence halls, compulsory R.O.T.C. training.

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Calendar.—School operates on semester system—summer, spring, and fall.

Expenses.—Total yearly expenses for new students have been from $645-$670 (exclusive of personal incidentals) for new students and from $560-$580 for old students. Matriculation fee is $25 for state residents and for nonresidents is an amount equivalent to that charged Texans by a similar school in the nonresident's state.

WITH a 1946-47 enrollment of 553, the petroleum engineering department of Texas Agricultural and Mechanical College is one of the largest in the nation.

Harold Vance, B.S., LL.B., is professor and head of the department. Albert B. Stevens, B.S., M.S., is professor, and Robert L. Whiting, B.S., M.S., is associate professor. Dean of engineering for the school is Howard W. Barlow.

A variety of degrees are offered by the department, including B.S., M.S., Ph.D., and B.P.E. (Bachelor of Petroleum Engineering). The B.S. degree is granted in petroleum engineering, geological engineering, and as a combination petroleum-mechanical engineering degree. The regular undergraduate curriculum is 4 years, but a 5-year course is offered if desired.

Completely equipped laboratories are available for gas measurement and testing; core analysis; mud testing; and oil sampling, measurement, and testing. In addition, the department has an outdoor laboratory equipped with a drilling rig and various types of pumping equipment. Research laboratory facilities for measuring P.V.T. relationships are available.

Seventeen Specialized Courses

There are 17 specialized undergraduate petroleum courses offered by Texas A. & M. as follows: (Credit hours are in parenthesis) The petroleum industry (2), petroleum and structural geology (4), petroleum development (3), petroleum development laboratory (1), petroleum production methods (3), petroleum production methods laboratory (1), equipment and applications (3), natural gas and gasoline (3), gas-measurement laboratory (1), Texas oil and gas properties (3), management of oil and gas properties (3), oil measurement and transportation (2), oil measurement and transportation laboratory (1), petroleum problems (two 1-hour courses), and production research (two 3-hour courses).

The 1947 graduate of Texas A. & M. College with a B.S. degree from the petroleum engineering department received an estimated average starting salary of $265, as compared with $150 for 1941. Enrollment figures by classes for the 1946-47 school year were: freshman, 316; sophomore, 180; junior, 70; senior, 86; fifth year, 10; and graduate, 1.

There are two engineering societies open for membership to petroleum engineering students of the school. These are the Petroleum Engineering Club and a student chapter of the American Institute of Mining and Metallurgical Engineers.

QUESTIONS on TECHNOLOGY

by W. L. Nelson

Consulting Engineer

Sizing of Refinery Lines

What are common rates of flow for pipe lines in refineries? I am interested mostly in vapor lines and water lines, but any information you may have will be welcome.—F. E. C.

There are so many situations in refineries that only a few can be mentioned here. However, several references are given below which pertain to this problem.

Vapor lines are usually built for velocities of 50-100 ft. per second. This results in pressure drops about as follows for topping tower vapor lines (Back Pressure by Vapor Lines, The Oil and Gas Journal, March 30, 1944, page 90):

	psi. per 100 ft.
1 in.	1.4-5.1
4 in.	0.3-1.2
8 in.	0.2-0.6
12 in.	0.1-0.4
16 in.	0.3

The effect of pressure or kind of vapor is described on page 73 of the November 4, 1944, issue of The Oil and Gas Journal under the title of "Tower Back Pressure."

R. G. Lovell (Reference 1) suggests the following formula:

$$D = \sqrt{g/15.7}$$

in which g is the total distillate and water per hour (product, reflux, and steam) and D is the diameter of the vapor line in inches. This very conservative formula is apparently based on velocities of 20-30 ft. per second and gives pressure drops per 100 ft. of length of 4-in. and larger lines of only 0.06 psi. and lower. Reference 1 also discusses condenser rundown lines, reduced crude rundown lines, side-draw lines, and compressed air piping.

G. R. Adams (Reference 2) suggests that the pressure drops in water lines (4 in. and smaller) should not exceed 2.5 ft. of head per 100 ft. of pipe length, and for larger lines that maximum velocities should be 4 or 5 ft. per second.

Steam piping is also discussed by Lovell (Reference 3). For lines shorter than 300 ft., velocities of 1,000-1,200 ft. per minute per inch of inside diameter are reasonable. Thus, for 95 per cent quality steam at 50 psi. velocities of 6,000 to 10,000 ft. per minute are common, and if the steam is superheated and at pressures over 200 psi. the velocities range from 7,000 to 20,000 ft. per minute.

Numerous studies of the most economic diameter of pipe based on a balance between pipe cost and the cost of pumping have been developed (References 4 and 5). Genereaux finally derives the following simplified and approximate equation:

$$D = 2.2\,\frac{m^{0.448}}{p^{0.552}}$$

in which D is pipe diameter in inches, m is rate of flow in thousands of pounds per hour, and p is the density in pounds per cubic foot. Such an approach is useful for very long lines such as pipe lines for oil, gas, or water, or for certain continuous large-capacity services, but most refinery services involve special operational features that outweigh the cost of pumping. Even pipe size itself affects the economic balance, because heavier walls are required for large diameter high pressure pipe, heat losses are larger, insulation costs are greater, and heavier insulation is required on large lines.

References

1. Lovell, R. G.—Refinery Piping-Design of Stock Lines from Tower, Pet. Engineer, Midyear 1941.

2. Adams, G. R.—Velocity Sizing of Water Lines, Pet. Refiner, March 1947, p. 136.

3. Lovell, R. G.—Designing and Installing Refinery Steam Piping, Pet. Engineer, August 1941, p. 23.

4. Genereaux, R. P.—Fluid Flow Design Methods, Ind. Eng. Chem., 29, 385 (1937).

5. Sarchet & Colburn—Economic Pipe Size—Ind. Eng. Chem. 32, 1249 (1940).

6. Lovell, R. G.—Basic Considerations in Refinery Piping Design, Pet. Engineer, Jan. 1941, p. 49.

7. Lovell, R. G.—A Specific Problem in Refinery Piping Design—Pet. Engineer, March 1941, p. 44.

How Much to Invest In a Plant

If we know how much money is saved per year by a new process how can we decide how much of an expense is justified in building the plant?—F. C. B.

This department is not one of business accounting nor is it possible to explore the many possible arguments for a long or a short depreciation time, but in a most general way the investment can be estimated by the following formula:

$$\text{Saving year} = \frac{C}{Y} + \frac{Ci}{2}$$

$$\text{or } C = \frac{S}{1/Y + i/2}$$

$$\text{or } C = \frac{2YS}{2 = iY}$$

in which C is the allowable capital expenditure, S is the saving by the process in dollars per year, Y is the years of depreciation, and i is the interest rate (a fraction). Thus, if the yearly saving by a process is $8,000, the interest rate is 0.03 per cent, and the plant is depreciated in 2 years:

$$C = \frac{2 \times 2 \times 8{,}000}{2 + 0.03 \times 2} = \$15{,}500$$

The number of years (Y) to depreciate is mainly a function of the repairs and replacements required but the process may be one that can rapidly become obsolete and if so a small value of Y is necessary.

Recording Vapor Pressure

Note: F.L.K. notices our question of May 10 concerning the "Relation of Reid to True Vapor Pressure" and points out that Industrial Engineers, Inc., of Los Angeles, manufacture an industrial vapor pressure recorder. In their Bulletin No. 2 entitled, "Graphical Vapor Pressure," they record the following vapor-pressure data obtained by users of the industrial recorder:

Material—	True v.p. calculated†	R.v.p.	% Inc. of True over R.v.p.
Natural gasoline*	83.1	52.0	60
Natural gasoline*	59.7	51.0	17
Natural gasoline*	24.2	22.5	7.5
Natural gasoline*	22.2	20.4	8.8
Natural gasoline*	20.3	19.7	3.0
Natural gasoline*	20.3	19.7	3.0
Natural gasoline*	20.3	17.8	14.0
Natural gasoline*	20.1	18.4	9.2
Natural gasoline*	20.1	18.3	9.8
Natural gasoline*	20.0	18.3	9.3
Natural gasoline*	19.7	18.8	4.8
Straightrun gasoline	9.7	8.3	16.9
Refinery gasoline	7.2	5.9	15.7
Aviation gasoline	6.1	4.2	45.2

*Almost a bottle gas. †From hydrocarbon analyses.

The tabulation unfortunately does not lead to a direct relationship between the true and the Reid vapor pressure. It does amplify our statement that "there can be no exact factor . . ." Note that the magnitude of the deviations shown in the table are apparently not related to the vapor pressure of the material—the first (83.1 v.p.) and the last (6.1 v.p.) materials both deviate by more than 30 per cent and they are the extremes among the materials shown. Possibly the proportion of the lowest boiling component in the material to the rest of the material, is related to the deviation, or perhaps its vapor pressure compared to the vapor pressure of the next component in the mixture.

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SQUEEZE CEMENTING

at Record Depth

by Herndon David

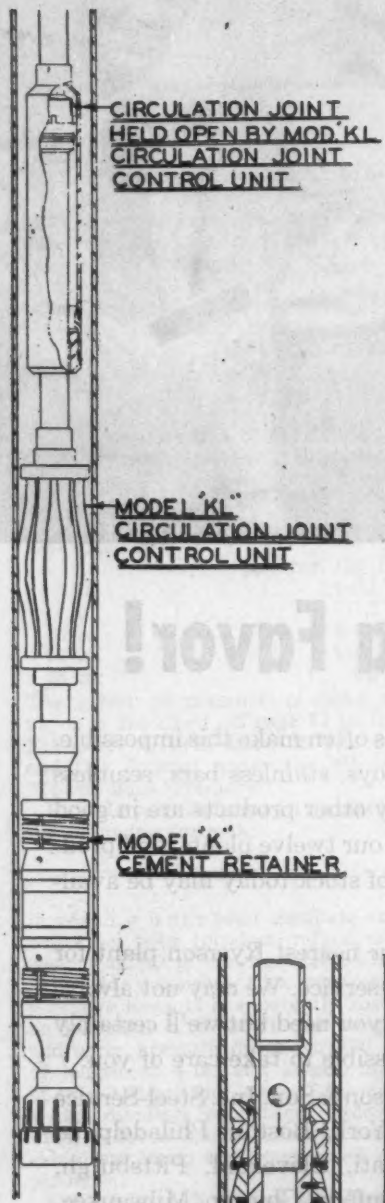

CIRCULATION JOINT HELD OPEN BY MOD. KL CIRCULATION JOINT CONTROL UNIT
MODEL "KL" CIRCULATION JOINT CONTROL UNIT
MODEL "K" CEMENT RETAINER

Fig. 1—(Above) Hookup of cementing tools used by Superior Oil Co. in performing world's deepest squeeze-cementing operation

AMONG the many records established during the recent drilling of the world's deepest well, Superior Oil Co. 51-11 Waller, in Caddo County, Oklahoma, was an unusual squeeze cement job in that although it established a world depth record of 16,274 ft. for such an operation, only standard equipment was employed.

Confronted with the task of squeeze cementing 7-in. o.d., 38.7-lb. casing at this extreme depth, operators of the well ran a Baker size 3A, model "K," magnesium-alloy cement retainer complete with junk pusher on a combination string of 2⅞ and 3½-in. drill pipe, and set the retainer at a depth of 16,274 ft. Auxiliary equipment employed consisted of a model "L" circulation joint and a model "KL" circulation joint control unit. The retainer and junk-pusher assembly was run on the bottom of the string, with the circulation joint control unit immediately above the retainer. Just above the control unit, and held open by it, was the circulation joint. Complete hookup of the equipment is shown in Fig. 1. Tools were run into the hole and retainer set in 5 hours and 45 minutes, a relatively short time for this depth.

The junk pusher attached at the bottom of the string served to push any junk or debris down the hole ahead of the cement retainer, thus preventing premature tripping of the retainer due to foreign material fouling in the slips.

The cement retainer was used to aid the placing of the cement through the drill pipe at the desired point. Since the retainer packs off the casing near the area to be squeezed, its use in this instance also minimized the danger of bursting the casing with the high pressures required to force the cement away.

Operating details of the cement retainer selected for use in the 51-11 Weller may be seen in Fig. 2. The hydraulic principle employed to set

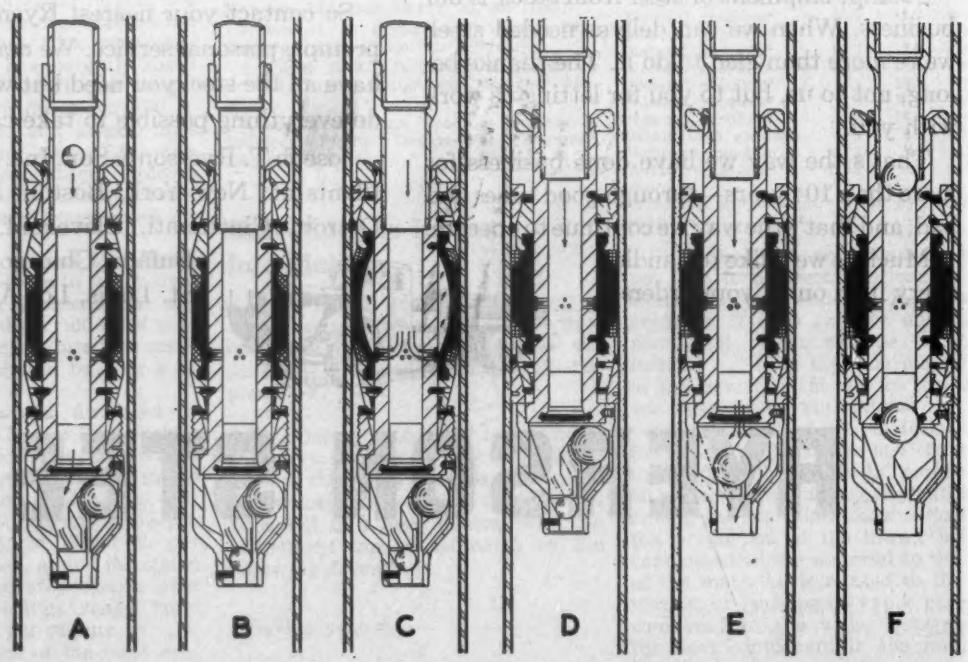


Fig. 2—(Right) Operating details of cement retainer

the retainer eliminates the necessity for any auxiliary setting mechanism. The principle involves the use of a small tripping ball which is dropped into the running-in string after the retainer reaches the desired setting point in the well. This ball is shown near the top of the retainer in Fig. 2A.

After it is dropped into the running-in string, sufficient time must be allowed for the ball to reach its seat as shown in Fig. 2B. After the tripping ball is seated, it closes any further circulation passage through the retainer, and circulating pumps may then be started slowly and pressure gradually built up. As pressure builds up in the retainer, fluid is forced out of several fluid ports and up behind the resilient packing, expanding it until it contacts with the casing. The packing, confined by the casing against further lateral movement, is then elongated by any additional pressure applied. Since the force necessary to shear the shear screws holding the upper cone to the body of the retainer and the upper slips to the cone is but one-half that required to shear the lower cone and slips, this expansion is upward and shears the screws holding the upper cone and slips. Further pressure then forces the slips to slide outward until the wickers contact with the casing as shown in Fig. 2C. Pumps must be stopped before the pressure exceeds 800 psi.

After the upper slips have been set and pumps stopped, pressure must be bled back to 200-300 psi. A strain is then taken in the running-in string which first causes the upper slips to grip the casing securely and prohibit further upward movement of the packing. The body of the retainer then moves upward within the packing assembly, shearing the screws holding the lower cone to the body and lower slips to the cone. The lower slips then slide outward and grip the casing, preventing downward movement of the retainer from that time on. Further strain on the running-in string then compresses the packing and completes the packing-off operation. This strain must be held on the string until the remaining pressure of 200-300 psi. is bled off.

After allowing a few minutes for the fluid behind the packing to drain out through the fluid ports and the packing to assume shape, as in Fig. 2D, sufficient pressure is applied to shear the screws holding the tripping ball seat unit and force the unit out the bottom of the retainer and down the hole. This allows the back-pressure ball valve to drop down onto the valve stop projections as shown in Fig. 2E. The projections hold the ball clear of the retainer openings permitting free passage of fluid during the cementing and circulating operations.

At the conclusion of cementing operations, the back-pressure ball is forced against its seat, as shown in Fig. 2F, by pressure from below the retainer, thus preventing fluid from moving back up the hole. Also shown in Fig. 2F is a bridging ball which may be dropped down the running-in string to prevent movement of fluid through the retainer in either direction and thus pack off the casing entirely.

The retainer body is so designed and made up of such metal that it can be drilled out after conclusion of cementing operations if it is desirable to deepen the well.

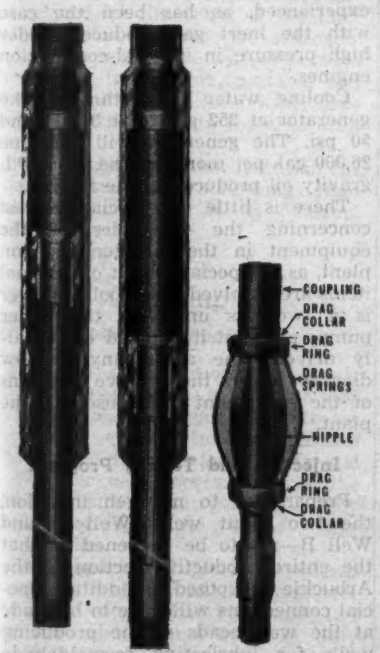


Fig. 3—The two figures at left show circulation joint in open and closed positions. Fig. 4—(Right) Circulation-joint control unit

Emergency Bypass

The circulation joint employed as auxiliary equipment was used by the Superior crews to provide a circulation bypass in case of emergencies. Since the joint can be opened and closed merely raising or lowering the running-in string a short distance, the fluid being pumped down the string can be laid off into the casing at any time. Fluid preceding the cement can, therefore, be kept out of the formation being squeezed or from going behind the casing or liner. The circulation joint can also be placed in a particularly open, or no-strain, position and thus insure relief from all strains when the running-in string is being unscrewed from the retainer. The circulation joint is shown in both open and closed positions in Fig. 3.

The circulation joint control unit used as the second piece of auxiliary equipment in Superior's well was designed primarily to support the weight of the retainer, thus permitting the circulation joint to be kept in the open position. The unit consists of a nipple equipped with a coupling on the upper end. A drag spring assembly which is free to rotate and move upward and downward is mounted on the nipple, Fig. 4. Upward travel of the assembly is limited by the coupling and downward travel by a sub screwed onto the nipple. When a hookup such as that used by Superior is run into a well, the drag springs contact with the casing, thus supporting the weight of the retainer and preventing it from extending the circulation joint into the closed position.

Bottom-Hole Conditions

Bottom-hole temperature in the 51-11 Weller at the time of cementing was approximately 287° F., and formation breakdown pressure varied from 2,200 to 2,700 psi. with 16-lb. mud, having a viscosity of 50 and a high causic content, in the hole. Final standing pressure was recorded at 3,400 psi.

In view of the bottom-hole conditions, slow-set cement was selected for the squeeze job. A total of 100 sacks was mixed, and 90 sacks displaced during the operation. Cementing time, the elapsed time from start of mixing cement to job completion of the squeeze, was 2 hours. No unexpected difficulties were encountered during the entire operation, and tests run following completion of the cementing showed that the job was highly successful and had accomplished a satisfactory shutoff.

Since this first squeeze operation was completed, there have been four additional squeeze-cement jobs completed at various depths up the hole from the first. Pertinent facts of these other jobs are listed below.

Second job: Size 3A magnesium retainer set at 16,180 ft. and 200 sacks of cement squeezed with a maximum pressure of 4,400 psi.

Third job: Size 3A magnesium retainer set at 14,100 ft. and 150 sacks of cement squeezed with a maximum pressure of 4,400 psi.

Fourth job: Size 3A magnesium retainer set at 13,413 ft. and 200 sacks of cement squeezed with a maximum pressure of 7,000 psi.

Fifth job: Size 3A magnesium retainer set at 13,100 ft. and 100 sacks of cement squeezed with a maximum pressure of 4,500 psi.

During none of these jobs was any unexpected difficulty encountered nor any trouble experienced in obtaining a satisfactory shutoff.

Texas Power & Light Plans New Subsidiary

Texas Power & Light Co. has filed an application with the Securities Exchange Commission to form a new corporation called Gas & Oil Producing Co., whose purpose would be to acquire and develop oil and gas lands of the parent company.

Nitrogen Repressuring Agent

(Continued from page 73)

stored in a 150-bbl. tank adjacent to the generator. The oil is filtered before entering the generator. The gases resulting from the combustion of the oil are exhausted at 3 psi. (maximum) and 95° F. The gases next pass through a scrubber and regulator into a 3-stage, 300-hp. compressor which brings the gases up to 1,000 psi. From the compressor, the injection gas goes through a 2-in. line to the two input wells.

Details of Generator

Inert-gas generators, such as the one used in this installation, have many general uses. In refineries they are used for purging stills, gas purifiers, oil tanks, pipe lines, agitators, and other gas-handling apparatus; blanketing vacuum filters in solvent-dewaxing processes; blanketing tanks used for storage of oil and gasoline; and blanketing of catalyst and carbon black in catalytic cracking processes. Among the other common uses are: producing nitrogen by using ammonia and hydrogen as fuel; blanketing volatile liquid tanks on oil tankers; preventing the ripening and decay in the handling and storage of fruit; and preventing oxidation of dried milk and other products during canning.

Over-all dimensions of the generator being installed at Silica are: length, 12 ft. 6 in.; width, 8 ft. 3 in.; and height, 6 ft. 9 in. (See picture). Air and oil are pumped separately, in the proper proportions, to the burner of the generator. Torch ignition is then used to fire the oil. Combustion takes place under pressure and the products of combustion are forced out at pressures from 15-in. water gage to 3 psi. The products are then cooled by water spray in two cooling chambers. The combustion chamber and spray cooler are of welded steel. Automatic controls are provided to shut the generator down in case of flame failure or cooling water failure. Temperature of the inert gas can be controlled by the operator.

Some variation over or under rated capacity is possible, in the generator, by varying the amount of fuel and air fed to the burner, or by varying combustion chamber pressure. As described by the manufacturer, "Observation of the flame through peepsights provided for this purpose, enables the operator to keep the flame at the desired color, and together with the regular analysis, permits close control of the inert gas.

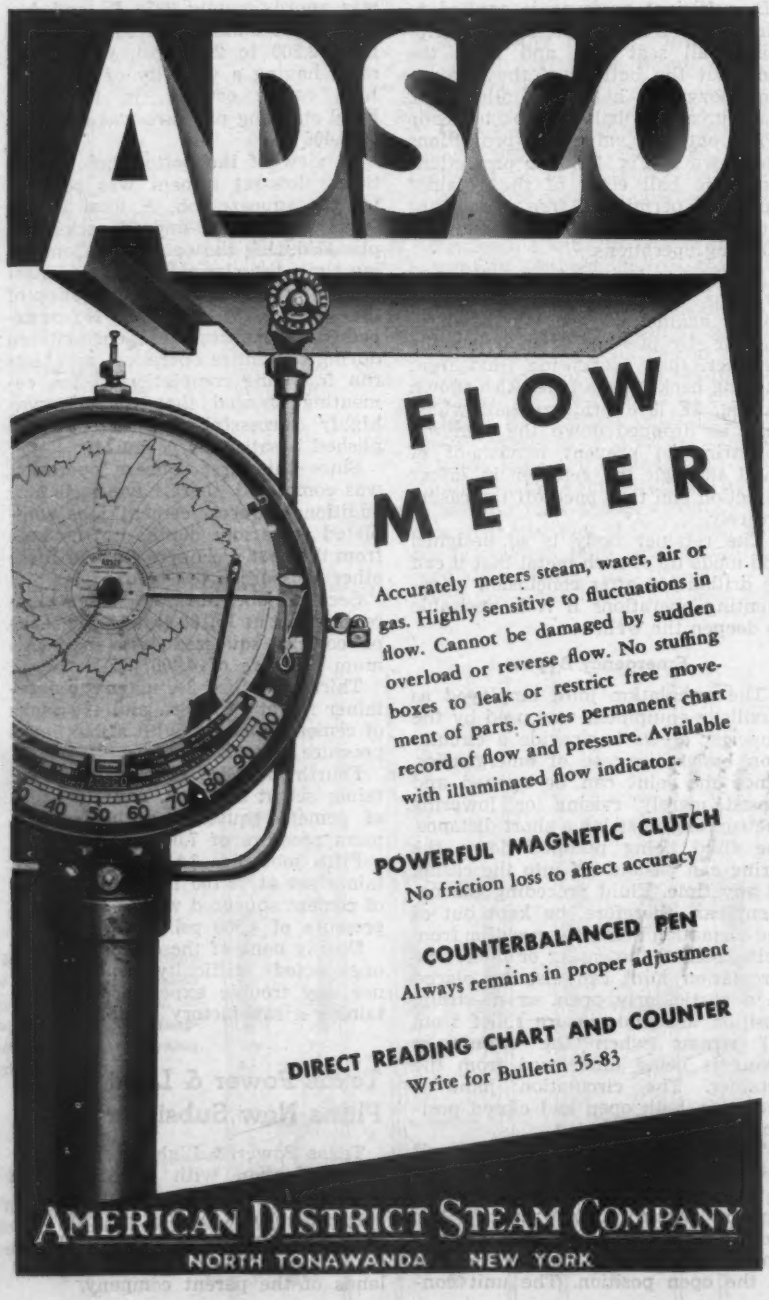
"The inert gas is cooled in a horizontal spray cooler by direct contact with cooling water . . . Because combustion is at low pressure, nitric oxide in the inert gas is practically nil and no trouble from corrosion has been experienced, as has been the case with the inert gas produced under high pressure in internal-combustion engines."

Cooling water flows through the generator at 252 g.p.m. at 84° F. and 50 psi. The generator will consume 26,000 gal. per month of the 42° A.P.I. gravity oil produced in the field.

There is little of especial interest concerning the remainder of the equipment in the nitrogen-injection plant, as no specially built or unusual items are involved. The cooling tower is a two-pass unit and the water pumps are centrifugal and electrically driven. The accompanying flow diagram shows the relative positions of the equipment to be used in the plant.

Injection and Testing Program

Preparatory to nitrogen injection, the two input wells—Well A and Well B—are to be deepened so that the entire productive section of the Arbuckle is exposed. In addition, special connections will have to be made at the well heads of the producing wells for lubricating formaldehyde down the annulus. Heretofore, there has been no gas produced with the oil and it was not necessary to lu-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bricate the formaldehyde (which is used to combat down-hole corrosion).

Well A (future injection well) is presently producing 18 bbl. of fluid daily, 98 per cent of which is water. Well B (future injection well) was temporarily abandoned in November 1946, at which time it was making 100 per cent water. Offset wells to Well A were producing on July 1 as follows:

PRIMARY OFFSETS

	Oil	Water
A 1	14	192
A 2	23	1
A 3	2	61
A 4	8	8
A 5	6	637

SECONDARY OFFSETS

A 6	10	0
A 7	9	284
A 8	26	160
A 9	4	0
A 10	9	54
A 11	9	289

Offset wells to Well B were producing as of July 1 as follows:

PRIMARY OFFSETS

	Oil	Water
B 1	4	176
B 2	14	450
B 3	15	294
B 4	14	343
B 5	2	273

SECONDARY OFFSETS

B 6	9	430
B 7	18	130
B 8	11	346
B 9	9	445
B 10	34	154
B 11	40	142
B 12	16	256
B 13	40	209

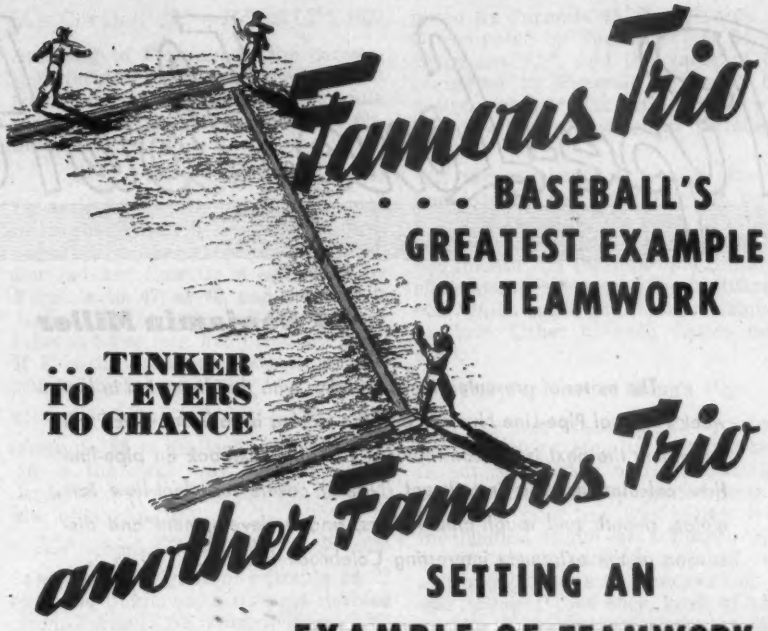
To test the results of the nitrogen-injection program, recording pressure gages and orifice well testers are being placed on the vents of the tank batteries to measure the nitrogen. A 2-oz. back pressure will be held on the vents. In addition, portable test units will test the oil and water production of the wells in the area on a 2-week schedule.

Men in charge of the operation for Stanolind are H. G. Nething, field superintendent, and W. R. Warren, field engineer.

Fuel-Oil Consumption Shows Sharp Increase

Fuel oil consumption by electric utility power plants in July totaled 3,714,959 bbl., a 13.5 per cent increase above the consumption of 3,273,323 bbl. during the previous month and a 47.9 per cent increase above the 2,511,780 bbl. consumption for July 1946, according to the Federal Power Commission.

Gas consumption by electric plants increased in July 14.2 per cent over the same month last year and 12.7 per cent above June 1947. In July 37,289,414,000 cu. ft. of gas were consumed, as compared to 32,638,696,000 cu. ft. during July 1946 and 33,078,-037,000 cu. ft. in June 1947.

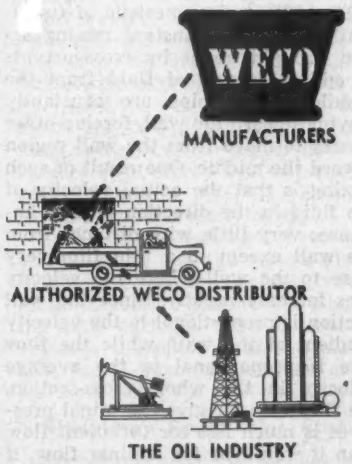


SETTING AN EXAMPLE OF TEAMWORK IN THE OIL FIELD

Old-timers in baseball . . . and the thousands of fans who jammed the stands game after game . . . will long remember the thrill of watching the smooth teamwork of baseball's great trio . . . Tinker, Evers and Chance. They formed the greatest combination in baseball history, setting records that have never been equaled in the annals of America's favorite game.

During the same years that Tinker, Evers and Chance were setting records in baseball history, another combination . . . manufacturers, distributors and oil men . . . began building a record of teamwork in the oil industry. Every year since oil country distributors set up shop, soon after the Drake Discovery Well, as a convenience to Oil Men and manufacturers alike, these distributors along with manufacturers have expanded facilities and services until today they cover the entire field of industry-wide operations.

And at these authorized WECO distributors, you'll find complete stocks of quality WECO Unions, Blocks and Compounds . . . Chiksan Products, Anchor Burners, Okadee Valves, Hamer Line Blinds and Valves that have gained a reputation for dependability throughout the oil



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Pipe-Line Flow Formulas

by Benjamin Miller

The material presented here, together with the discussion in last week's Annual Pipe-Line Number and the closing installment which will appear in the next issue, constitutes a veritable textbook on pipe-line flow calculations. This installment (No. 2) covers turbulent-flow formulas, smooth and rough-pipe factors, and a development and discussion of the extremely interesting Colebrook function.

WHEN the Reynolds number is 2,000 or less any flow disturbance is gradually damped out as the fluid travels through the pipe. When the Reynolds number exceeds 2,000, disturbances tend to persist, and when the Reynolds number exceeds 3,000 the turbulent mode of flow is stable.

The salient characteristic of turbulent flow is the constant mixing action brought about by crosscurrents or eddies. Masses of fluid from the middle of the pipe are constantly moving toward the wall, forcing other masses to move from the wall region toward the middle. One result of such mixing is that the actual velocity of the fluid in the direction of flow increases very little with distance from the wall except in a thin film very close to the wall where the velocity does increase rapidly. Since the wall friction is proportional to the velocity gradient at the wall, while the flow rate is proportional to the average velocity in the whole cross-section, the flow rate for given terminal pressures is much less for turbulent flow than it would be for laminar flow, if laminar flow were stable.

As the Reynolds number is increased above 3,000 the mixing action becomes more intense, the film near the wall in which there is a high velocity gradient gets thinner, and the difference between the observed flow rate and that which would be calculated by the laminar-flow formulas increases.

Detailed treatment of the velocity distribution in turbulent flow is outside the scope of this discussion; however, it may be pointed out that there is a definite turbulent-flow pattern for each value of the Reynolds number. A complete theory of turbulent flow has not yet been developed, and until one shall have become available we must use empirical formulas.

Turbulent-Flow Formulas

Many attempts have been made to fit a formula to the relationship between the friction factor and the Reynolds number for turbulent flow in smooth pipe. Since it was customary to plot the logarithm of the friction factor against the logarithm of the Reynolds number, and such a plot is nearly straight over a short range, the formulas usually took the form:

$$f = a + b\,N_R^{n} \qquad (49)$$

in which a, b, and n are constants. Each extension of the range of Reynolds numbers covered brought forth a new set of constants, and none of the formulas was used to any great extent.

But when the flow coefficient C_f is plotted against the logarithm of the Reynolds number N_R there is obtained a line which is straight over the entire turbulent-flow range, as far as the experiments have gone. This straight-line relationship was published by the present author[9] in 1937. The formula for the straight line is:

$$C_f = 1.80 \log_{10} N_R - 1.53 \qquad (50)$$

Formula 50 is sometimes referred to as the Miller formula.

Drew, Koo, and McAdams[3] published in 1932 another straight line relationship between C_f and N_R, but did not give any formula; later in the same year Nikuradse[12] published the same relationship and gave the formula for the straight line, which is:

$$C_f = 2 \log_{10} (N_R/C_f) - 0.8 \qquad (51)$$

Formula 51 is sometimes referred to as the Nikuradse formula.

A third straight-line relationship between C_f and N_R was published by the present author[9] in 1936; it is:

$$C_f = 0.373 \log_{10} (N_R^2/C_f^2) - 1.25 \qquad (52)$$

The utility of Formulas 51 and 52 may not be immediately apparent, since they cannot be solved readily for C_f. But Formula 51 makes possible a direct solution for the flow rate, as pointed out by Drew, Koo, and McAdams, while Formula 52 makes possible a direct solution for the diameter. This may be shown in the following way:

Dividing Formula 10 by Formula 9:

$$N_R/C_f = [2\,D^3\,(-dP/dL)\,\rho]^{0.5}/\mu \qquad (53)$$

which combined with Formula 51 yields:

$$C_f = 2 \log_{10} \{ [2\,D^3\,(-dP/dL)\,\rho]^{0.5}/\mu \} - 0.8 \qquad (54)$$

Formula 54 can be used to calculate C_f when the flow rate is not known, after which Formula 30 can be used to solve for the flow rate.

Combining Formulas 2 and 10:

$$N_R = 4\,Q\,\rho/\pi\,D\,\mu \qquad (55)$$

Raising Formula 55 to the fifth power and dividing by the square of Formula 30:

$$N_R^5/C_f^2 = 128\,Q^3\,\rho^3\,(-dP/dL)\,\pi^3\,\mu^5 \qquad (56)$$

combining Formulas 52 and 56:

$$C_f = 0.373 \log_{10} [128\,Q^3\rho^3(-dP/dL)/\pi^3\mu^5] - 1.25 \qquad (57)$$

Formula 57 can be used to calculate C_f when the diameter is not known, and then Formula 30 can be solved for D.

Formulas 52, 54, and 57 are empirical representations of experimental data, and the values of C_f calculated with them are not identical, but are not further apart than the experimental uncertainty, which is about 2 per cent.

Comparing Formula 29 with Formula 52, and Formula 28 with Formula 54, and Formula 31 with Formula 57, it may be seen that in laminar flow the flow coefficient is an exponential function of a dimensionless number formed by the flow variables, while in turbulent flow the flow coefficient is a logarithmic function of the same dimensionless number. The three dimensionless numbers used are $Q\rho/D\mu$, $D^3(-dP/dL\,\rho/\mu^2$,

and $Q^2 \rho^4 (-dP/dL)/\mu^6$. Two other dimensionless numbers could be formed, one without μ and one without ρ, but there seems to be no practical use for them.

Practical Formulas for Turbulent Flow of Liquids in Smooth Pipe

Using the conversion factors which were employed above to get a practical formula for laminar flow of liquids from Formula 23, but applying them to Formula 30, we obtain:

$$B = 4.06\ (d^3\ I/s)^{0.4}\ C_f \qquad (58)$$

which may be used for laminar or turbulent flow in smooth pipe, provided the proper value of C_f is employed. For laminar flow C_f may be obtained from Formula 42, Formula 43, or Formula 44, and the flow is laminar if C_f is found to be 5.6 or less by one of these three formulas.

There are three corresponding formulas for turbulent flow. If I is the unknown, C_f may be calculated by a practical form of the Miller formula obtained by conversion of Formula 50, which is:

$$C_f = 1.80 \log_{10} (B\ s/d\ z) + 2.01 \qquad (59)$$

If B is the unknown, a practical form of the Nikuradse formula is used to calculate C_f; this formula, obtained by conversion of Formula 54, is:

$$C_f = \log_{10} (d^3\ s\ I/z^2) + 4.35 \qquad (60)$$

The formula to be used to calculate C_f when d is the unknown, obtained from Formula 57, is:

$$C_f = 0.373 \log_{10} (B^3\ s^4\ I/z^2) + 2.91 \qquad (61)$$

Formulas 59, 60, and 61 like Formulas 50, 54, and 57, yield results for C_f which are not identical, but do not differ by more than 2 per cent.

When the value of C_f calculated by one of these formulas is 4.6 or greater, it may be used in Formula 58 to obtain B, I or d; however, when value of C_f so calculated is between 4.6 and 5.0 the flow may not be stable. When the value of C_f so calculated is less than 4.6 the conditions are not consistent with stable turbulent flow.

There is a relatively small range of flow conditions such that the value of C_f calculated by Formula 42, 43, or 44 is greater than 5.6, while the value of C_f calculated by Formula 59, 60, or 61 is less than 4.6. This is the transition region, where the flow is not stable, and rapid fluctuations are likely. While no formula will give reliable results under such circumstances, Formula 58 with a value of 5.1 for C_f will give results which are approximately correct.

Practical Formulas for Turbulent Flow of Ideal Gases at Constant Temperature in Smooth Pipe

Combining Formulas 30 and 32:

$$M = C_f \pi [k\ D^5\ (-2P\ dP/dL)/16]^{0.5} \qquad (62)$$

which is integrated from beginning to end of the pipe by:

$$M = C_f \pi\ [k\ D^5\ (P_b^2 - P_e^2)/16\ L]^{0.5} \qquad (63)$$

Applying to Formula 63 the conversion factors previously used to get from Formula 34 a practical formula for laminar gas flow, there is obtained:

$$Q_s = 2{,}740\ (F\ d^5/G\ T)^{0.5}\ C_f \qquad (64)$$

Formula 64 may be used for laminar or turbulent flow in smooth pipe, provided the proper value of C_f is used. For laminar flow C_f is computed by Formula 46, 47, or 48, and the flow is laminar if the value of C_f so calculated is 5.6 or less. For turbulent flow, if F is the unknown, C_f may be calculated by means of:

$$C_f = 1.80 \log_{10} (Q_s\ G/d\ \mu) - 13.01 \qquad (65)$$

Formula 65 is derived from Formula 50, in the same way as Formula 62 is derived from Formula 30. If Q_s is the unknown, use:

$$C_f = \log_{10} (G\ F\ d^3/T\ \mu^2) - 6.67 \qquad (66)$$

which is derived from Formula 54. If d is the unknown, a formula derived from Formula 57 is used; it is:

$$C_f = 0.373 \log_{10} (Q_s^2 G^4 F/T\mu^2) - 10.58 \qquad (67)$$

If the value of C_f calculated by Formula 65, 66, or 67 is 4.6 or greater, it may be used in Formula 64 to calculate Q_s, F, or d. If the value of C_f so calculated lies between 4.6 and 5.0, the flow may not be stable.

There is a range of flow conditions such that C_f calculated by Formula 65, 66, or 67 is less than 4.6, while C_f calculated by Formula 46, 47, or 48 is greater than 5.6. This is the transition region, where flow conditions are unstable, and no formula may be depended upon to give reliable results. It is recommended that in this region Formula 64 be used with C_f taken as 5.1, it being understood that the results will be only approximately correct.

Pipe-Line Efficiency in Turbulent Flow

If the rate at which fluid is actually flowing through a pipe line is measured, and the terminal pressure conditions, the inside diameter and length of the line, and specific gravity and viscosity of the fluid are all known, a value of C_f can be computed from these, using Formula 58 for a liquid and Formula 64 for a gas. Another value of C_f may be computed from the flow rate, the pipe diameter, and the specific gravity and viscosity of the fluid, using Formula 59 for a liquid and Formula 65 for a gas. The following discussion is limited to cases in which the value of C_f computed by Formula 59 or 65 is 5.0 or greater, which indicates conditions such that turbulent flow would be stable in smooth pipe.

In general the value of C_f computed by Formula 58 is less than the value of C_f calculated by Formula 59, while the value of C_f computed by Formula 64 is less than the value of C_f computed by Formula 65. If the value of C_f computed by Formula 58 or 64 be designated C_f^*, and the value of C_f computed by Formula 59 or 65 be designated C_f^{**}, the ratio C_f^*/C_f^{**} is the pipe-line efficiency in turbulent flow.

If the efficiency of a pipe line is found to be less than 100 per cent, which is generally the case, there are two possible causes—(1) the pipe is not smooth; (2) the pipe line contains elements, such as joints, bends, fittings, etc., which cause additional resistance to flow. Either or both causes may exist.

The Problem of Rough Pipe

In the past the influence of joints, bends, fittings, etc., has not had sufficient recognition, and the fact that the friction factor computed from a test on a pipe line was higher than the friction factor for a smooth pipe at the same Reynolds number was attributed to pipe roughness alone. It was thought that each kind of pipe had its characteristic roughness, that a curve of friction factor against Reynolds number could be prepared for each kind of pipe, and that the performance of a pipe line could be predicted from the friction factor-Reynolds number curve for the particular kind of pipe used in the construction of the line. The expression "kind of pipe" includes at least four elements—the material of which the pipe is made, the method of manufacture, the diameter, and the surface treatment, if any—for new clean pipes; and in addition, an age factor. Thus there were curves for new galvanized steel pipe, 4 to 6-in.; asphalt-coated cast-iron pipe, 20 years old, 14 to 42-in.; and many others.

Collections of test data were made and analyzed and the results plotted in the hope that regularities could be found. Elaborate schemes for classifying pipe surfaces were invented to embrace the mass of data, and friction factor-Reynolds number curves were presented for each classification.

Nikuradse's Rough Pipe Studies

An entirely different method of attack on the rough-pipe problem was also advocated—laboratory investigation on pipes (not pipe lines) having controlled roughness. This method was employed by Nikuradse[13] in an extensive series of tests.

Nikuradse coated the inside walls of brass pipes with carefully sized sand grains. He used pipes having inside diameters of 1, 2, and 4 in.; and sand grains having diameters of 0.004, 0.008, 0.016, 0.032, and 0.064 in. By combining the pipes and sand grains in various ways, he got six grades of roughness, which can be expressed by the ratio of the pipe diameter to the sand-grain diameter. Thus a 1-in. pipe with 0.032-in. grains had a d/k ratio of 30 (k is the diameter of the sand grains, in inches), while a 4-in.

pipe with 0.004-in. grains had a d/k ratio of 1,000.

Nikuradse's results included the following:

1. Pipes having the same d/k ratio had the same value of C_f at the same value of N_R.

2. All the pipes were smooth up to a value of N_R of 2,000, the end of the laminar régime.

3. In the turbulent régime the pipes were smooth up to a Reynolds number given by Formula 68:

$$0.9 \log_{10} N_R = 1.36 + \log_{10} (d/k) \quad (68)$$

Formula 68 indicates that a pipe with a d/k ratio of 76 would be rough for all Reynolds numbers above 4,000, while a pipe with a d/k ratio of 1,000 would be rough for all Reynolds numbers above 70,000.

4. As the Reynolds number increased above the value for which a pipe became rough, the flow coefficient continued to increase, but more slowly than it would have for a smooth pipe, reached a maximum, then decreased, and finally became constant.

5. The constant value of the flow coefficient was that given by Formuls 69:

$$C_f = 2 \log_{10} (d/k) + 1.14 \quad (69)$$

This is very close to the maximum value of C_f for smooth behavior, which is given by Formula 70:

$$C_f = 2 \log_{10} (d/k) + 1.2 \quad (70)$$

6. The value of the Reynolds number at which the flow coefficient became constant was not well defined, but it was given at least approximately by Formula 71:

$$\log_{10} (N_R/C_f) = \log_{10} (d/k) + 2.28 \quad (71)$$

7. The transition from smooth-pipe behavior to constant flow coefficient (called completely rough behavior) required three formulas for its expression; these are:

$$C_f = 1.13 \log_{10} (N_R/C_f) + 0.87 \log_{10} (d/k) + 0.07 \quad (72)$$

$$C_f = 2 \log_{10} (d/k) + 1.54 \quad (73)$$

$$C_f = -0.588 \log_{10} (N_R/C_f) + 2.59 \log_{10} (d/k) + 2.47 \quad (74)$$

Formula 72 covers the portion of the transition region in which C_f is increasing; this extended to a Reynolds number given by:

$$\log_{10} (N_R/C_f) = \log_{10} (d/k) + 1.30 \quad (75)$$

Formula 73 covers the portion of the transition region in which C_f has its maximum value; this extended to a Reynolds number given by:

$$\log_{10} (N_R/C_f) = \log_{10} (d/k) + 1.60 \quad (76)$$

The portion of the transition region in which C_f is decreasing is covered by Formula 74.

Rough-Pipe Studies by Colebrook and White

The friction factor-Reynolds number curves published by Nikuradse to represent his results with sand-lined pipe were so different from the curves which were in vogue for "commercial pipe" that it was generally concluded by authorities on fluid friction that the "artificial" roughness used by Nikuradse was not geometrically similar to the "natural" roughness of commercial pipe. Colebrook and White[2] pointed out that the projections and depressions in commercial pipe would not all be of the same size and shape, but would have various sizes and shapes, so that experiments with controlled roughness of various types would be necessary to discover relationships which might apply to natural roughness.

Accordingly, they made experiments with a 2-in. pipe and sand grains of two diameters—0.014 in. and 0.14 in. They used five roughnesses in all, as follows:

1. Uniformly covered with fine sand.

2. Uniformly covered with a mixture of fine and coarse sand, 2.5 per cent being coarse.

3. Uniformly covered with a mixture of fine and coarse sand, 5.0 per cent being coarse.

4. Forty-eight per cent uncovered, balance covered with a mixture of fine and coarse sand, 10 per cent being coarse.

5. Ninety-five per cent uncovered, balance covered with coarse sand.

With the uniform coating of fine sand they obtained results similar to those of Nikuradse, in that the pipe behaved as though it were smooth at low Reynolds numbers; then as the Reynolds number increased the flow coefficient at first increased slowly, reached a maximum, then decreased, and finally became constant. However, the agreement was not quantitative. The actual d/k ratio was 145, but the maximum Reynolds number for smooth-pipe behavior and the constant value of the flow coefficient for completely rough behavior corresponded to a d/k ratio of about 106 when calculated by Formulas 68 and 69. Colebrook and White decided that there was some difference between their uniform sand coating and that of Nikuradse, and that their fine sand had an "effective" diameter of 0.019 in., which made the "effective" d/k ratio 106. However, by Formula 73 the maximum value of C_f and a d/k ratio of 106 is 5.59, while Colebrook and White actually found a maximum C_f of 5.92. Thus making an adjustment to bring their results into agreement with Nikuradse's in the completely rough region did not cause agreement in the transition region.

The other four roughnesses gave results which were different from those obtained with roughness 1 in that smooth-pipe behavior was not found at any Reynolds number used; however, no attempt was made to extend the experiments to low Reynolds numbers. With each roughness the value of C_f increased as the Reynolds number increased, reached a maximum, then decreased and finally became constant.

The constant value of C_f found for each roughness was inserted in Formula 69, and an effective d/k ratio thus calculated. Using the effective d/k ratio a curve was plotted for each roughness the variables being:

$$[C_f - 2 \log_{10} (d/k) + 0.6] \text{ and}$$

$$[\log_{10} (N_R/C_f) - \log_{10} (d/k) + 0.6]$$

Nikuradse had plotted his results in the same way, and had found that they fell on a single curve; Colebrook and White found that there was a different curve for each of their five roughnesses, and that all five differed from Nikuradse's curve.

Then Colebrook and White took a long step forward. They examined the results which Heywood had obtained in testing a commercial galvanized pipe. The value of C_f increased regularly with the Reynolds number, though more slowly than it would for a smooth pipe, until a maximum value was reached; thereafter it remained constant. This was in contrast to the behavior of sand-lined pipe, which showed a decrease from the maximum value to the constant value; however, with roughness 5 the increase was quite small. The maximum value of C_f for the galvanized pipe was inserted in Formula 69 and an effective d/k ratio calculated. Using this effective d/k ratio, a curve was plotted for the galvanized pipe, again using the variables:

$$[C_f - 2 \log_{10} (d/k) + 0.6] \text{ and}$$

$$[\log_{10} (N_R/C_f) - \log_{10} (d/k) + 0.6]$$

The curve thus obtained for the galvanized pipe was similar to the curve for roughness 5, which encouraged the belief that this method of plotting, devised to correlate data on artificial roughness, might be useful for correlating data on natural roughness.

The Colebrook Function

Following his work with White on artificial roughness of varied kinds, Colebrook[3] proposed a theory of natural pipe roughness. He suggested that the relation between the friction factor and the Reynolds number was the same for all commercial pipe, new and old, and that one kind of pipe differed from another only in the value of its roughness characteristic, a number having the dimension of length, which might for convenience be considered as the diameter of the equivalent Nikuradse sand grain, and called the k-value. On the basis of a suggestion by White, a relation between friction factor, Reynolds number, and k-value or roughness length was obtained by combining the

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Nikuradse formula for smooth pipe:

$$C_f = 2 \log_{10} (N_R/C_f) - 0.8 \quad (51)$$

and the formula for completely rough behavior:

$$C_f = 2 \log_{10} (d/k) + 1.14 \quad (69)$$

to get

$$C_f = 2 \log_{10} (d/k) + 1.14 + 2 \log_{10} (N_R/C_f) - 2 \log_{10} [(N_R/C_f) + 9.35 (d/k)] \quad (77)$$

Though Colebrook made plain that it had been suggested by White, Formula 77 is called the Colebrook function.

It will be noted that the last term in Formula 77 is twice the logarithm of the sum of (N_R/C_f) and 9.35 (d/k). If 9.35 (d/k) is small compared to (N_R/C_f), which will be the case for very rough pipe because then k is a large fraction of d, the last term approaches 2 $\log_{10}$ (N_R/C_f), and then the difference between the last term and the next-to-last term approaches zero, which makes the formula as a whole approach Formula 69, the formula for completely rough behavior. At the other extreme, if 9.35 (d/k) is large compared to (N_R/C_f), which will be the case for very smooth pipe because then k is a small fraction of d, the last term approaches 2 $\log_{10}$ [9.35 (d/k)], which is 2 $\log_{10}$ 9.35 + 2 $\log_{10}$ (d/k); since 2 $\log_{10}$ 9.35 is 1.94, the last term approaches 1.94 + 2 $\log_{10}$ (d/k), which makes the formula as a whole approach Formula 51, the smooth-pipe formula.

Colebrook tested Formula 77 against such friction data as he could find, and concluded that certain types of new commercial pipe were smooth, that others were rough, and that the behavior of the rough ones (with certain exceptions, such as some riveted pipe) was in accordance with the formula.

In addition to brass pipe, Colebrook found that pipe with spun bitumastic or spun concrete lining was smooth; so also was concrete pipe made against oiled forms. Four types of new pipe found to be rough, and whose behavior checked Formula 77, were galvanized pipe, cast-iron pipe, tar-coated cast-iron pipe, and wrought-iron pipe. The k-values for these four were calculated by Formula 69, extrapolating the friction factor-Reynolds number curves when necessary to obtain a constant friction factor. Of particular interest is wrought-iron pipe, since steel pipe which is used so extensively for oil and gas pipe lines would be expected to behave more like wrought-iron pipe than like any of the other three.

Colebrook's k-values were 0.0017 in. for wrought iron, 0.005 in. for tar-coated cast iron, 0.006 for galvanized, and 0.01 in. for uncoated cast-iron pipe; these values were for new material, and Colebrook suggested that in the case of water lines they would increase with time.

Recent Advocacy of the Colebrook Function

In 1943 Rouse[10] published an extremely important paper in which he pointed out that then current engineering literature continued to use the old exponential resistance formulas, and at times evidenced complete misunderstanding of the importance of viscosity and roughness. He then discussed some of the newer experimental material, and pointed out that the experiments of Colebrook and White on artificial roughness of varied kinds lead to the conclusion that each statistical combination of surface protuberances should produce its own characteristic friction factor-Reynolds number curve. Nevertheless, he continued, Colebrook found that wrought-iron pipe, galvanized pipe, and asphalted cast-iron pipe followed a single relationship, that expressed by Formula 77, which is Equation 8 of Rouse's paper.

While this formula is obviously too complex to be of practical use, Rouse went on, if the function it embodies is even approximately valid for commercial pipe in general, such extremely important material could be made readily available in diagrams or tables.

To test the validity of Formula 77 Rouse plotted the measurements reported by several investigators on various pipes, including 2 and 4-in. old wrought iron, 1 and 2-in. galvanized, 3-in. wrought iron, 3 and 4-in. cast iron, 6-in. spiral-riveted steel, 12-in. tarred cast iron, and 72.5-in. wood-stave pipe. These were first plotted in the usual form of logarithm of friction factor against logarithm of Reynolds number, and extrapolated to get minimum friction factors. From the minimum friction factors effective d/k ratios were calculated by Formula 69, and then the data were replotted as Colebrook and White had suggested, using as variables:

$$[C_f - 2 \log_{10} (d/k) + 0.6] \text{ and}$$

$$[\log_{10} (N_R/C_f) - \log_{10} (d/k) + 0.6]$$

A somewhat similar study had been made by O'Brien, Folsom, and Jonassen[11]—not to test the Colebrook function, since they did not know about it at the time, but to test Colebrook's and White's belief that this method of plotting would be useful for correlating data on natural roughness. Rouse mentioned this previous study, saying: "Contrary to Colebrook's conclusion, O'Brien, Folsom, and Jonassen—far from finding the same transition curve for different boundary materials—asserted that they could not obtain a representative curve for even the same material in different pipe sizes." Rouse contended, however, that the variation found by O'Brien, Folsom, and Jonassen is beyond practical significance, because the deviation of the points for the 11 series he had plotted from the line representing Formula 77 was not much greater than the experimental scatter of the individual measurements in any one series. Only the points for the spiral-riveted pipe seemed to follow a somewhat different curve, he stated, and even in this case the deviation from the general trend was not serious.

On the basis of this test, Rouse recommended Formula 77 as a close approximation to the actual resistance law. That it might be conveniently used, he presented a chart having a large number of curves, each for a different d/k ratio, ranging from 20 to 400,000. The chart had two scales—$\log_{10} f$ against $\log_{10} N_R$, and C_f against $\log_{10} (N_R/C_f)$. The latter scale was the basic one, so that the lines of constant N_R/C_f were straight; this made the lines of constant N_R curved.

The chart included a table of k-values, approximately the same as those given by Colebrook, but with the addition of a value for steel. The value of k for both steel and wrought-iron pipe was given as 0.0018 in., slightly greater than Colebrook's 0.0017 in.; it was stated that the k-values applied to pipe in new condition.

With regard to joints, Rouse implied, connections of various types and frequency will not affect the validity of Formula 77, but may alter the effective value of k to an appreciable degree, so that systematic experimental study of this phase would be desirable.

In 1944 Moody[12] published a paper which enthusiastically recommended the Colebrook function. This paper contained two charts to facilitate use of the function. One was a chart of pipe diameter against d/k ratio; on this chart were lines of constant k-value for commercial steel or wrought iron, cast iron, etc. The k-values were the same as those which had been given by Rouse, except that a value for drawn tubing had been added; this value was 0.00006 in., one-thirtieth as great as the value for commercial steel or wrought iron. The other chart contained a large number of curves, each for a different d/k ratio, ranging from 20 to 1,000,000, and each being a plot of $\log_{10} f$ against $\log_{10} N_R$. Moody acknowledged the valuable prior contribution of Rouse, and claimed only that his chart would be more convenient to use than the one Rouse had presented, because in the Moody chart the lines of constant N_R were straight.

Some Implications of the Colebrook Function

If Formula 77, with k taken as 0.0018 in., were an accurate representation of the behavior of clean pipe lines constructed with commercial steel pipe, the value of Colebrook's contribution to the design of oil and gas pipe lines would be extremely

great. Accordingly, when the paper by Rouse became available, the values of C_r predicted were compared with test results on natural-gas lines. For a 12-in. line, for example, the maximum value of C_r is 8.79 by Formula 77, yet test results ranged up to and slightly over 10; test results for a 20-in. line ranging up to 10.2 contrasted with a maximum predicted value of 9.2.

When the paper by Moody appeared shortly thereafter, and the Colebrook function recommendation was made again and by another authority, further study was given to the matter, but with the same result—the flow coefficients predicted by the Colebrook function were substantially lower than those which were attained in natural-gas-line operation. This information was transmitted to Professor Moody, with the suggestion that the flow tests on which the Colebrook function had been based had been made with water, and that the function might apply to pipe which had been corroded by water, but not to new pipe, or pipe which had been used only with noncorrosive fluid.

In reply Professor Moody agreed that the figures were primarily obtained from tests on water, and stated that it was not surprising that the roughness in dry gas lines is smaller than with usual conditions applying to water; he added: "Since the Colebrook function is consistent with the smooth pipe line for small roughness, this merely means to me that the pipe is actually much smoother than assumed from values based on water piping, requiring a new line in Fig. 2." Professor Moody's position seemed to be that the Colebrook function, Formula 77, will give the correct answers, if the proper value of k is used; this value may be much smaller than 0.0018 in. for absolutely new pipe.

If the functional form of Formula 77 is correct, the efficiency of a clean pipe line should be substantially 100 per cent at low flow rates, but should decrease rapidly as the flow rate increases above a critical value, and the change in efficiency with flow rate should follow a particular course fixed by a single parameter, the k-value. This is not the case, according to evidence presented below.

There may not be a single value of k applicable to all new clean commercial steel pipe lines, which is what Professor Moody suggests, but the Colebrook function may perhaps still apply, with a separate k-value for each line. This possibility is suggested, though not so stated, by Ferguson,[4] who tentatively advocated the application of the Colebrook function to gas flow calculations in a recent publication.

According to Ferguson, investigation of the literature on the subject of friction factors lead him to the conclusion that the Colebrook formula represents at present the closest approximation to the correct value of the friction factor for various values of Reynolds number, as it takes the roughness of the pipe into account. Because no means have yet been devised to determine the relative roughness (that is, the effective d/k ratio) of a given section of pipe from direct surface measurements, he says, the only way it can be determined is through actual flow tests. A method of calculating pipe-line flow problems, based on the Colebrook function, was presented by Ferguson, but he emphasized that it was based entirely on published information, and may be disproved by the experimental work he plans to do. This method requires that before making flow calculations about a particular pipe line, the relative roughness be first determined by an efficiency test. The relative roughness is taken from a chart of efficiency against flow rate; the chart has lines showing how the efficiency decreases according to the Colebrook function, as the flow rate increases, each line being for a different d/k ratio, ranging from 200 to 2,000,000.

An Analysis of the Evidence for the Colebrook Function

If it should be proved that the Colebrook function is valid for clean steel pipe lines carrying noncorrosive fluids, but that each line has its own k-value, the importance of the Colebrook function and its usefulness will be somewhat less than they would be if a single k-value could be applied to all lines, but the function will still be applicable to estimate the efficiency at one flow rate from the known efficiency at another flow rate, which is the essence of the method tentatively proposed by Ferguson. Since the data at present available to the author do not suggest any change in efficiency with flow rate in the case of clean steel pipe lines carrying noncorrosive fluids, further investigation of the Colebrook function seems well warranted. Perhaps the tests to be made by Ferguson and referred to above will settle the matter; however, it appeared desirable to make an independent analysis of the evidence on which the Colebrook function's applicability to flow in clean steel pipe lines was advanced and accepted.

Colebrook himself evidently had no data from tests on steel pipe, and indeed he did not mention steel pipe. The tests on new wrought iron pipe used by Colebrook were those made by Freeman, as quoted by Mills.[3] It is not intended to suggest that steel pipe and wrought iron pipe differ in roughness, but to avoid misunderstanding it was desired to learn on what data Professor Rouse and Professor Moody had based their k-values for new steel pipe. In answer to inquiries Professor Rouse revealed that he had used data presented by Kemler,[5] while Professor Moody stated that the tests by Freeman[6] had been his principal source. While Kemler used the data of several investigators, it appears that he gave much weight to the results of Freeman, as quoted by Mills, for Kemler said "the most complete series of tests are those by Dr. John R. Freeman. His tests covered the entire range of pipe sizes, and the results in each case are seen to fall very close to the average curve. . . . An examination of the summarizing curves for steel pipes will show that Freeman's test results fall almost on the average curve for each case. His tests cover the entire range of pipe sizes and were apparently made with exceptional care."

It thus seems fair to say that Freeman's results on new wrought-iron pipe, either as quoted by Mills in 1923, or in the form published in 1941, are the principal basis for advocating the use of the Colebrook function for new steel pipe, and for assigning to new steel pipe the k-value of 0.0018 in. Freeman's tests were made in 1892, but it was not until 1941 that a complete account of them was published. The 1923 publication used by Kemler and Colebrook did not include the complete descriptions found in the 1941 publication of the pipes, test setup, etc. It may be mentioned that Drew, Koo, and McAdams also used the 1923 publication; they say: "Freeman's numerous tests on different sizes of pipe are an admirable example of the type of data available for a study of the effect of pipe diameter. It is evident that the smaller sizes generally give higher values of f for a given Reynolds number than do large sizes, yet Freeman's 2.5-in., 4.12-in., and 8-in. pipe all lie on substantially a single curve so that the formulation of an exact rule seems difficult." Study of the 1941 publication confirms the statement of Drew, Koo, and McAdams. The curves of $\log_{10} f$ against $\log_{10} N_R$ for the 4, 5, 6, and 8-in. pipes are almost coincident, substantially higher than the smooth pipe curve, and very close to the curve for the 2.5-in. pipe. The curve for the 3-in. pipe is substantially higher than that for the 2.5-in. pipe. The curves for the seven smaller sizes (2 to 0.25-in.) are also higher than that for the 2.5-in., but not in strict order of size, and they cross one another. On the basis of these curves, therefore, the conclusion that Colebrook's function applies to Freeman's new wrought-iron pipes would appear unwarranted; in fact, the broader basic idea that a small pipe will exhibit a higher friction factor than a large pipe at the same Reynolds number finds no support in the test results on Freeman's new wrought-iron pipes of 2.5-in. and greater diameter.

Even if the Colebrook function were a good representation of the behavior of the new wrought-iron pipes tested by Freeman in 1892—which, as has

Baash-Ross News

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. . . 2 *The usual flush design with no shoulders for stopping a slipping drill collar.*

. . . 3 *The drill collar's hard heat-treated surface that reduces gripping efficiency.*

and 4 *The relatively low drill string weight available for wedging the slips into the bowl.*

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Sizes and Operating Ranges of Baash-Ross Drill Collar Slips

SIZE*	Operating Range	
	From	To
A	3"	4½"
B	3¾"	5¼"
C	4¼"	5¾"
D	5½"	7"
E	6¾"	8¼"

*(all sizes available in both "Regular" and "Long" types)

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Baash-Ross Drill Collar Slips are available in two types —"Regular" and "Long." The "Long" type has extensions above the gripping area to provide a seat for the Baash-Ross Safety Clamp — the clamp that puts a non-slip, *yet removable*, "stop shoulder" on *any* drill collar to compensate for the hazards of flush design when supporting the collar in the table. For complete details see your nearest Baash-Ross representative — or write direct!

The "why" of Baash-Ross Drill Collar Slips

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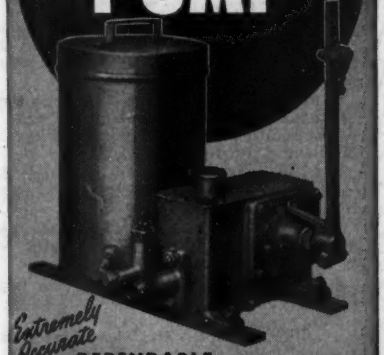

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just been demonstrated, is not the case—it would not necessarily follow that the Colebrook function would apply to flow in modern steel or wrought-iron pipe lines. There have been great changes in the art of pipe manufacture, and improvements in joining pipe, since 1892. It would appear extremely hazardous to design a pipe line today on the basis of tests made in 1892 unless similarity were first established. The description of the pipes used by Freeman, and of the joints, was not published until 1941, and was not available to Colebrook. Some part of that description may well be included here, that the reader may compare the pipe lines of today with the ones Freeman tested.

Freeman made up his pipe lines of pieces of pipe about 15 ft. long, joined by screwed couplings. When the ends of the pipe were threaded, they were burred and compressed. The burrs were carefully removed, but the compression at the ends remained. The result of the compression was that the inside diameters of the pipes at the ends were substantially less than they were along the pipes generally. In the case of the 6-in. pipe the difference amounted to about 0.06 in.

The pipes tested by Freeman he considered to be fairly representative of good ordinary lap weld pipe. He described the 6-in. pipe as follows:

"In the whole lot of 6-in. pipe almost every long piece, in addition to the scabs and scales, contains a few bunchy spots. Some of these appear to be patches of fused scale or slag, others are small bunches or iron. Hardly a bunch or protuberance in the whole 200 ft. projects over ⅛-in. from the general surface, but quite a number of rounded bunches with a base of 1-in. to 2-in. diameter, project ⅛ in. perhaps.

"There are a dozen of these in the whole 200 ft. of pipe, located very irregularly, and generally the sides are of such easy slopes that they would not cause any contraction beyond their height.

"There are a considerable number of slag spots and iron bunches with base diameter about ½ in. to 1 in. and which project $\frac{1}{16}$ in. These two types of bunches are irregularly located and scarcely any section of 5 in. long is free from one or more such.

"The general surface (approximately the whole area has been 'ironed out' and leveled off by the contact of the plug and the welding rolls) is by no means smooth.

"One-half the surface is covered by ridges almost all of which run along the pipe. The other half is covered with pits and patches of scale, giving a rough surface with hills and valleys 1/50-in. in depth, and spaced from ¼-in. to 1-in. apart. The scabs of scale generally have abrupt edges."

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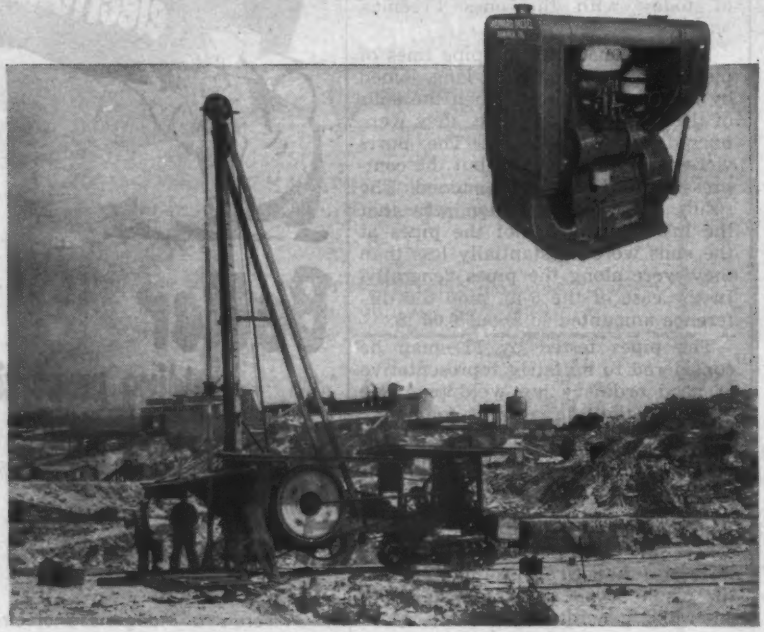

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tend that the foregoing description could apply to present-day new wrought-iron or steel pipe such as would be used in oil or gas pipe lines.

Freeman also tested pipe lines constructed with brass pipe, old wrought-iron pipe, cast-iron pipe, and others. The brass pipe lines were made with butt joints, covered with sleeves, so that each line was equivalent to a single pipe. Freeman's results on turbulent flow in brass pipe agree with those of other investigators. The results he obtained on lines constructed with other types of pipe are not relevant to the present inquiry, but it is significant that the friction factor-Reynolds number curve for the 8-in. tar-coated cast-iron pipe was slightly lower than the curve for the 8-in. wrought-iron pipe.

It appears therefore that the principal evidence which has been offered in support of the idea that the Colebrook function describes the behavior of new steel pipe lines is the work of Freeman; that Freeman's tests on new wrought-iron pipe lines are not consistent with the Colebrook function, in that the friction factor-Reynolds number curves for the 2.5, 4, 5, 6, and 8-in. lines are practically in agreement with one another, though much higher than the smooth-pipe curve; and that Freeman's description of his new wrought-iron pipe, and of the joints in his lines, does not suggest that his pipe lines could properly be considered similar to modern pipe lines.

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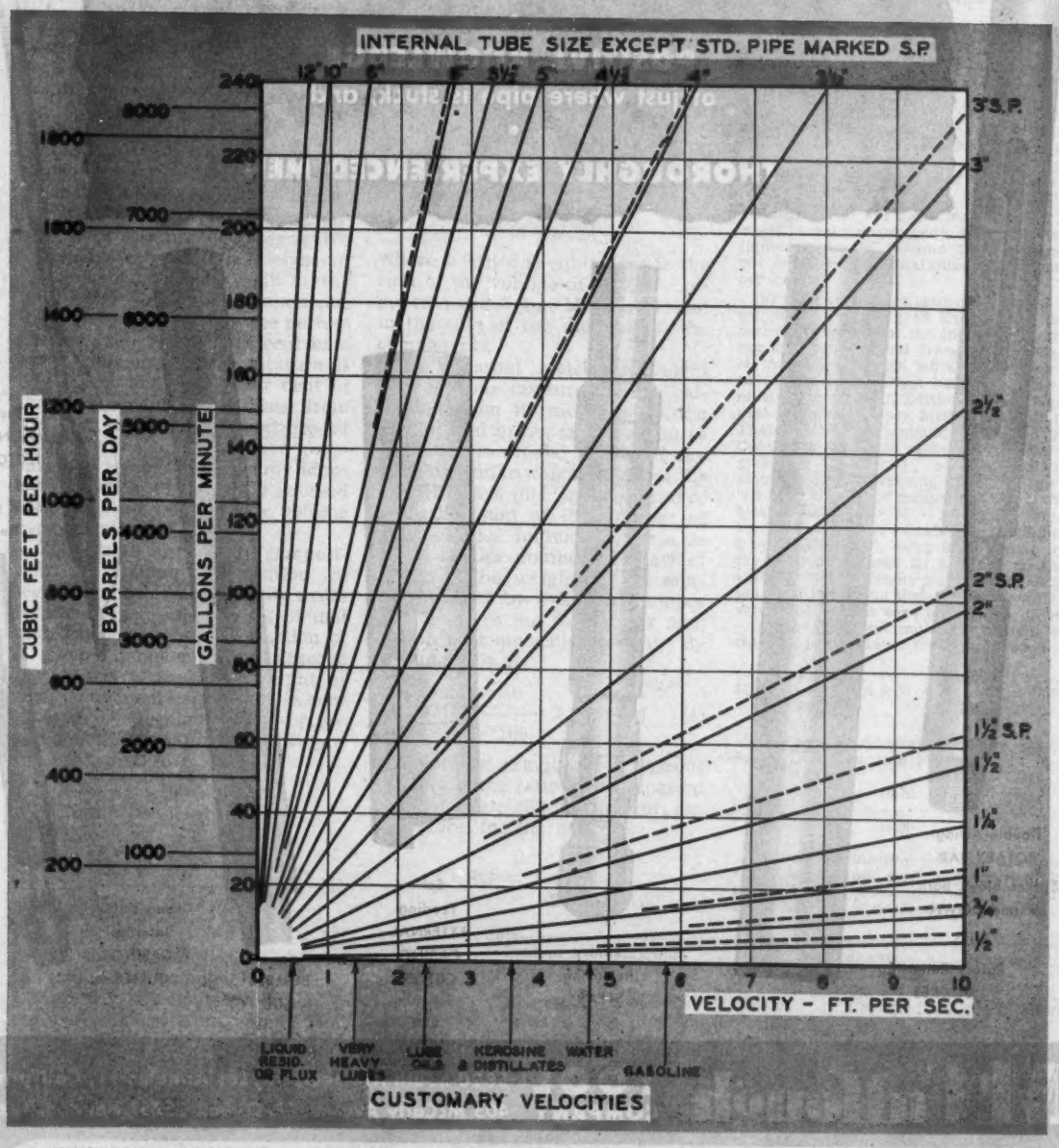
Velocity and Pipe Size



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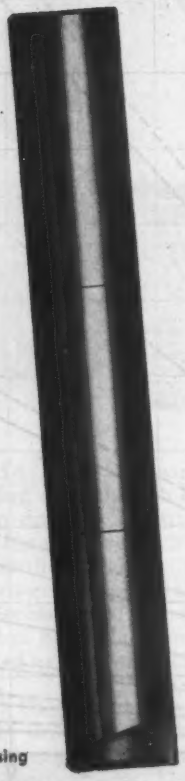
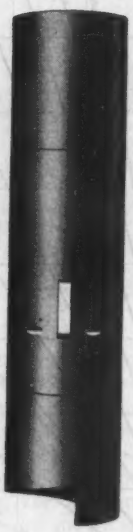


Rotary Releasing
SOCKET

Rotary
Releasing
SPEAR



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ENGINEERING *fundamentals*

Standard Calculations for Gases

GAS compositions are expressed in terms of mol per cent or fraction, volume per cent, and weight per cent. The mol fraction of any component in a mixture of gases is equivalent to the number of mols of that particular component divided by the total number of mols of all the components. The mol per cent of a component is equivalent to 100 times the mol fraction. Similarly, the weight per cent of a component in a mixture of gases is 100 times the ratio of the weight of that particular component to the total weight of all the components.

For gases which obey the perfect gas law, the volume per cent of a given component in a mixture is equivalent to the mol per cent of that component. This arises from the fact that molar quantities of perfect gases under a given pressure and temperature occupy identical volumes. It should be stressed that mol per cent equals volume per cent only for gases.

Conversion from molar composition or volume composition to weight composition is readily made by recalling the definitions of mol and density. If the mol fraction of a given component in a gaseous mixture is y, then the weight of that component is $y \times M$, where M is the molecular weight of the component. By definition of weight per cent, therefore,

$$\%m = \frac{100 \times y \times M}{\Sigma y \times M} = \frac{100 \times \%n \times M}{\Sigma \%n \times M} \quad (1)$$

where, $\Sigma y \times M$, or $\Sigma \%n \times M$, means the sum of the weights of the individual components.

Similarly, since density, $d = m/V$ one can convert from volume per cent to weight per cent by the following:

$$\%m = \frac{100 \times \%V \times d}{\Sigma \%V \times d} = \frac{100 \times \%V \times SG}{\Sigma \%V \times SG} \quad (2)$$

where again $\Sigma V \times d$ or $\Sigma V \times SG$ means the sum of the weights of all components.

To convert from weight per cent to volume per cent or mol per cent, one can use the following relationship:

$$\%V = \%n = \frac{100 \times \%m/d}{\Sigma \%m/d} = \frac{100 \times \%m/M}{\Sigma \%m/M} \quad (3)$$

where $\Sigma \%m/d$ is equivalent to the sum of the volume of all the components and $\Sigma \%m/M$ is equivalent to the sum of the mols of all the components.

An apparent molecular weight of a gaseous mixture can be calculated from its mol composition and utilized in the same fashion as is the true molecular weight of any gas. Molecular weight signifies the weight of one mol. In a mixture of gases the sum of the number of mols of the individual gases is taken as the number of mols of mixture. The weight of the mixture divided by this total number of mols gives the weight per mol, or apparent molecular weight. By formula, this is

$$M = \frac{1}{100} \Sigma \%n \times M \quad (4)$$

The specific gravity of a gaseous mixture is the ratio of its apparent molecular weight to that of air. Therefore, for the mixture,

$$SG = \frac{M}{28.96} = \frac{\Sigma \%n \times M}{100 \times 28.96} \quad (5)$$

Since the value of M for each component is equivalent to its SG times 28.96, the formula for computing the specific gravity of a mixture can be given in terms of the specific gravity of each component, instead of in terms of molecular weight, thus,

$$SG = \frac{\Sigma \%n \times SG}{100} \quad (6)$$

Example: Gas from the Hill zone, Rodessa field, Caddo Parish, Louisiana, is reported in U.S.B.M., R.I. 3715, to have the components and per cent volume composition as given in Columns 1 and 2 of the table below. What is (a) the mol per cent, (b) the weight per cent of each component in the gas, (c) the apparent molecular weight of the gas, and (d) its specific gravity?

Solution: (a) For gases mol per cent is equal to volume per cent; therefore, the figures given in Column 2 for volume per cent are used in Column 3 for mol per cent.

(b) The weight per cent composition is computed according to Equation 1, the molecular weight of the individual components being found from the molecular formulas or from tables of data such as that given on Page 106 in the Technical Manual (Fifth Edition) of the Natural Gasoline Supply Men's Association. These molecular weights are listed in Column 4. Since no molecular weight is given for heptanes +, that for heptane alone is used. Entries in Column 5 give $\%n \times M$ for each component, and the total gives $\Sigma \%n \times M = 1{,}870.3$. Per cent by weight is then calculated in Column 6 by dividing each entry in Column 5 by the total of Column 5. A check on the validity of the weight per cent values is obtained by noting that their sum which should be 100 per cent is equal to 100.04.

(c) The apparent molecular weight of this gas is calculated from Equation 4.

$$M = \frac{1}{100} \Sigma \%n \times M = \frac{1{,}870.3}{100} = 18.70$$

(d) The specific gravity of the gas is found from Equation 5

$$SG = \frac{18.70}{28.96} = .645$$

New nomenclature.—%m = weight per cent composition; y = Mol fraction, in gas; %V = Volume per cent composition; %n = Mol per cent composition.

Given data		Solution			
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Component	% by vol.	% by mols	Mol wt.	3 × 4	% by weight (100 × V ÷ 1870.3)
Methane	87.09	87.09	16.04	1,398	74.8
Ethane	4.42	4.42	30.07	133	7.12
Propane	1.60	1.60	44.09	70.5	3.76
Iso-Butane	0.40	0.40	58.12	23.2	1.24
Normal-butane	0.52	0.52	58.12	30.3	1.62
Pentanes	0.46	0.46	72.15	33.2	1.77
Hexanes	0.29	0.29	86.17	25.0	1.33
Heptanes +	0.06	0.06	100.20	6.0	0.32
Nitrogen	4.76	4.76	28.02	133.5	7.14
Carbon dioxide	0.40	0.40	44.00	17.6	0.94
Total	100.00	100.00		1,870.3	100.04

Series prepared by Dr. John C. Calhoun, Jr., Petroleum Engineering School, University of Oklahoma

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MODERN Rotary DRILLING

Diesel Engines

PRESENT number of diesel-engine-powered rotary rigs is relatively small if considered as a percentage of total rigs now in actual operation. There is, however, a trend toward increased use of diesel power for rotary drilling. This trend is a result of several factors relating to characteristics of the engine itself and to the inherent advantages of diesel power, considered from the point of view of requirements of modern drilling.

Engine.—One of the improvements in design of diesel engines in the last few years is the steadily bettered weight-to-power ratio. This makes the diesel engine lighter and easier to move, an important attribute for rotary-drilling application. Efficiency, reliability, and economy are other important factors. With drilling cost-per-foot rapidly increasing, as the depth of the wells drilled increases, operators and drilling contractors find in use of diesel engines a means of holding down some of the component parts of this cost.

Need for specialized maintenance has always been one of the disadvantages of diesel engines for oil-field work. There has been considerable improvement in this situation since the end of the war. A number of oil-field workers received a thorough training during their service with the armed forces in the servicing of diesel engines. In many cases present drilling crews are entirely capable of maintaining the rig's diesel engines.

Fuel.—The past few years have seen marked change in appraisal of value of natural gas. This is the result of increased use of gas for conservation purposes, as a source for liquid fuels, and increased use in chemical and other industries. In view of this increased value of gas and in view of the economy of diesel fuel in comparison with other liquid fuels, the competitive position of the diesel engine has been greatly improved.

Reduced fire hazard when using diesel fuel is an important factor. Also, ease of transportation of diesel fuel must be considered in case of difficult locations such as barge and offshore drilling.

Gas-Diesel Engine

The gas-diesel engine is an important development. In this engine dual fuel equipment is provided. Gas is used in the engine, with only small percentage of normally needed oil used for firing of the gas charge. This arrangement combines the efficiency of the diesel cycle with the ability to use gas, if and when cheaply available. The gas-diesel engine is not a new development. In its application to rotary drilling, however, it is only in the initial stages of evolution. The advantages which such an engine would offer as a prime mover of rotary rigs are obvious.

Synchronization.—In compounding, proper synchronization is even more important for diesel engines than in the case of other types of internal-combustion engines. It is also more difficult. The importance of synchronization is due to the sensitivity of the diesel engine's speed and power to fuel feed. The difficulty is in the manner of determining the loading of the engine. In other internal-combustion engines the fuel intake-manifold vacuum may be used conveniently as means for controlling the fuel intake to engines. In diesel engines, loading is measured by determination of exhaust temperatures. The intervals between changes in loading in rotary-rig operations, particularly during the hoisting cycle, are too short to permit evaluation of loadings and the making of needed corrections.

An important contribution toward facilitating application of diesel power for rotary drilling has been development of a special pneumatic throttle control. The throttles of the engines are operated pneumatically from the central control. The speeds of the engines are synchronized by initial setting of throttles. In operation, balance of fuel supply to the compounded engines is then automatically maintained by the central control.

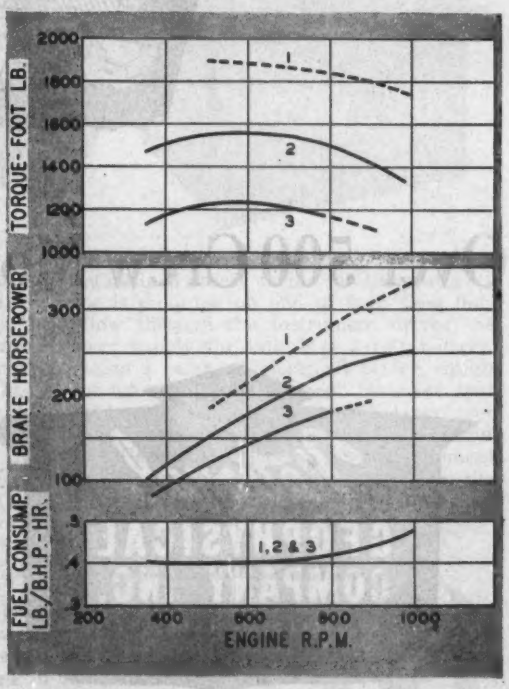

Fig. 38—Torque, horsepower, and fuel consumption are shown on these graphs of a six-cylinder diesel engine. Curves No. 1 represent maximum torques (upper chart) and horsepowers (lower chart) obtained with maximum fuel-pump setting (exceeding maximum fuel delivery). These Curves No. 1 are not to be used in application of the engine for any service; they are shown only to indicate the conservative ratings of the engine when operating on the application ratings of Curves No. 2 and No. 3

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Experience

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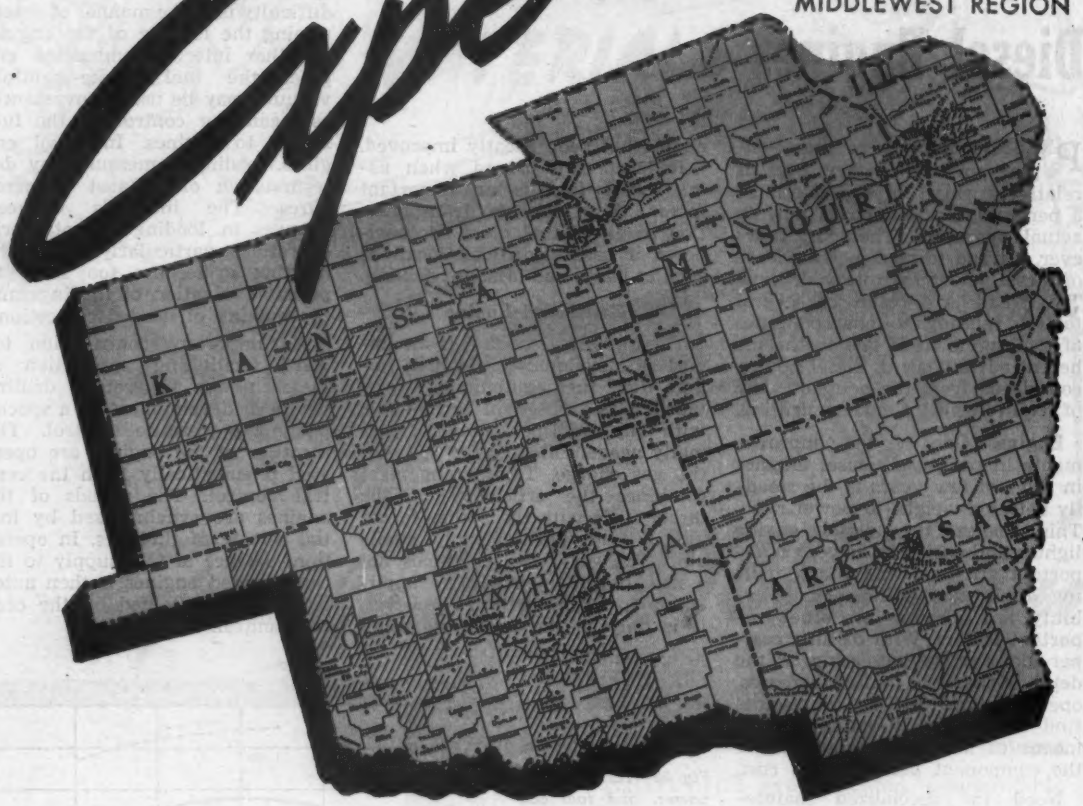


Over 500 Crew Months in This Area Alone!

National
GEOPHYSICAL
COMPANY INC.
DALLAS • TEXAS

8800 LEMMON AVE.

★ *This is the second of a series of experience maps which will show where National has conducted seismic surveys in various regions of the country.*

The shaded counties on the above map show where National crews have conducted seismic surveys in the past.

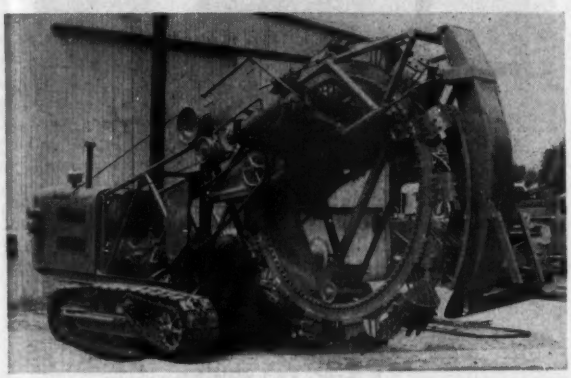
This vast amount of previous experience permits us to offer competent crews with specialized equipment and techniques for solving the wide variety of geological problems and field conditions which are encountered in this area.

OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

by John M. Spears

(1) NEW PIPE-LINE DITCHER for gathering lines, small product lines, short loops, and terminals excavates ditches from 16 to 30 in. wide to a depth of 6 ft.



Unit has digging speed up to 57.5 ft. per minute. Power is furnished by 67-hp. diesel at 1,600 r.p.m. Weight is 16,500 lb. A strong but light frame of tubular construction supports the digging wheel. Conveyor is reversible. *Buckeye Traction Ditcher Division, Gar Wood Industries, Inc.*

IT'S NEW CHECK IT

(2) NEW SINGLE-JOINT ELEVATOR, for tailing-in and laying down operations, is based on the center-latch design and incorporates a stirrup-type latch to insure positive closing. Elevator is furnished complete with wire-line sling and cat-line swivel, ready for use in the field. Use of this elevator for tailing-in operations is safer than the rope sling so often used for this purpose. Elevator also allows pipe to be supported absolutely vertically and saves time in aligning threads for spinning in. It will also save time and reduce accidents if used with drill pipe in making mouse-hole connections. *Web Wilson Oil Tools.*

IT'S NEW CHECK IT

(3) AUTOMATIC WELL-GAS DETECTOR, an instrument for continuous well logging, automatically detects oil and gas formations as well is being drilled by continuously analyzing mud returns. Instrument also indicates volume of gas present in mud at all times, thereby offering an additional safety factor for blowout prevention. Detector is mounted on end of mud flow line, and the mud flow through the instrument drives the mechanism. Power supply for unit is a 2-volt battery. Instrument contains a balanced electrical bridge circuit which has a hot wire-platinum filament in lower part of circuit. This filament is mounted in a chamber over which gas vapors pass, causing combustion to occur around filament. Electrical resistance of this filament changes, causing a current to flow in ratio to the amount of gas present in mud, which is registered on

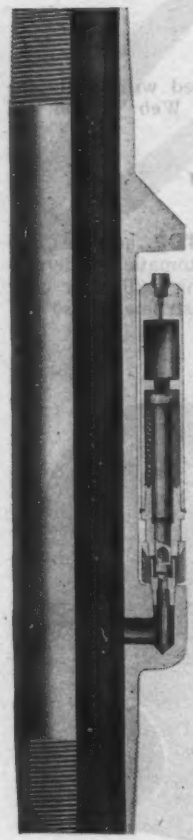
Intensity meter for gas detector at right

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

Keep Informed. Save Time. Tear Out Card. Check It. Mail It.

gas intensity meter. This meter is mounted on derrick floor in view of the driller. *Petroleum Instrument Co.*

IT'S NEW CHECK IT



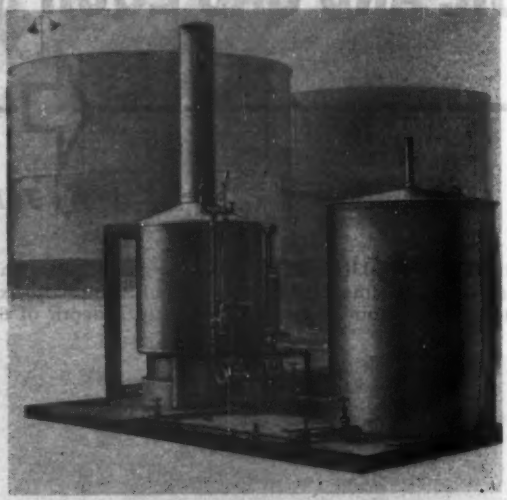
(4) NEW GAS-LIFT VALVES are pressure - charged, bellows - type valves which may be used to produce low or high-volume wells of any depth. Valves consist of an outer housing of stainless steel or monel which contains a seamless monel bellows, valve stem, and replaceable valve seat. Valve stem is permanently connected to top of bellows. During assembly of valve, a noncompressible liquid is introduced around the outside of bellows; the "pressure dome" above bellows then is charged to desired pressure and sealed. This pressure is exerted on outside of bellows and compresses it to keep valve stem on its seat under predetermined casing pressures. Under high casing pressures valves are in full open position, with reinforcing column of liquid sealed around outside of bellows to prevent undue differential pressure across bellows. Inside, bellows ars supported and guided by valve stem. Valves are externally mounted on mandrels which fit into tubing string, thus leaving a full opening through tubing. *Garrett Oil Tools.*

IT'S NEW CHECK IT

(5) NEW CHEMICAL FIRE EXTINGUISHER may be used by inexperienced operators to extinguish fires in flammable liquids, gases, solids, and electrical equipment, and also for controlling fires in ordinary combustibles. Extinguishing agent used, plus-fifty dry chemical, is nontoxic, noncorrosive, nonabrasive, and a nonconductor of electricity. Unit is 18½ in. long and 3½ in. in diameter and weighs only 4 lb. It is supplied with a quick-opening bracket for vertical or horizontal mounting in locations where space is limited. *Fire Extinguisher Division, Ansul Chemical Co.*

IT'S NEW CHECK IT

(6) STEAM-TYPE OIL HEATERS for dehydrating crudes, have no electrical controls or motors—a self-actuated steam pump is the only working unit. Boiler is fired by field gas, and develops 150-lb. pressure from



a cold start in 5 minutes. A positive shutoff valve controlled by water flow cuts off fuel to the burner in event of water-supply failure. Boiler has a flush-type tube construction which is explosionproof. *Super Mold Corp.*

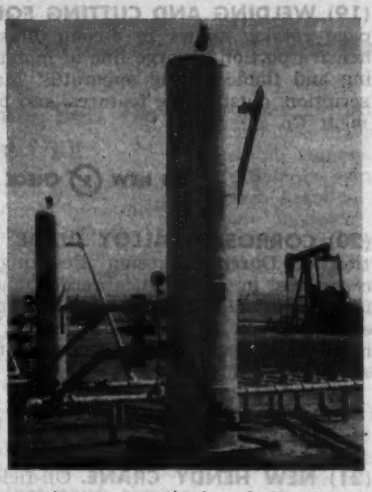
IT'S NEW CHECK IT

(7) SPECIAL SERVICE TRUCK for installation of a crane or winch and other special equipment, has a dirigible-duplex front-axle system which obtains maximum dynamic balance, unit efficiency, and load capacity from the structure. Four-wheel front-end suspension consists of two front axles so sprung that the load is equally

distributed between the two axles, with a steering linkage arrangement designed to provide the correct ratio of steering angles between the two axles under all conditions. Frame is lifted only one-half the height of any obstruction encountered by the wheels, due to equalizer beam action. Rear axle is a standard bogie type. Dual-service cab enables safe, efficient, and comfortable operation of cranes, winches, and other auxiliary equipment. Controls for special equipment are centralized in the rear compartment for convenient operation. Driver turns around facing the work in a comfortable position on the same seat which serves him for driving. *Milford Crane & Machine Co.*

IT'S NEW CHECK IT

(8) AUTOTROL, a floatless separator or gas trap, embodies a radically different means of controlling oil and gas flow. System has no stuffing box and no moving parts within tank. Differential pressure of gas and oil within tank, acting upon an enclosed diaphragm outside tank, actuates dual valves controlling flow of separated oil and gas. Maintenance costs are negligible, due to accessibility of valve-control mechanism on outside of tank. The Autotrol precision-built control mechanism consists of two valves directly connected to each other by a single stem operated by an intervening diaphragm. Pilot lines from oil and gas outlets lead to lower and upper sections respectively of diaphragm chamber so that actual movement of diaphragm becomes a function of liquid level within the shell. Weight of assembly normally holds oil valve closed until liquid in shell rises to a level a few inches above level of the diaphragm. Beyond this point an additional rise of less than 1 in. completely opens oil valve and closes gas valve. *Baroid Sales Division, National Lead Co.*

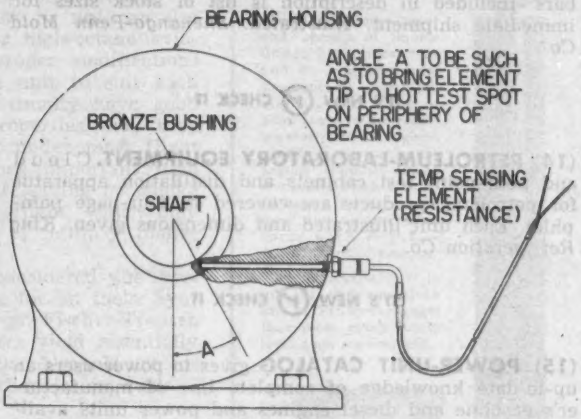


IT'S NEW CHECK IT

(9) EXHAUST - PIPE COVER provides weather and insect protection for oil-field engines. Cover is counterbalanced; engine exhaust pressures opens cap instantly—closes automatically when engine shuts down. Cap will close regardless of angle of pipe. There is no restriction or back pressure, assuring full horsepower output. Sizes of covers are from 1½ to 5¾-in. o.d. *Buda Oilfield Engine Distributors.*

IT'S NEW CHECK IT

(10) BEARING - TEMPERATURE MONITOR warns when bearings start overheating. New automatic, multi-point system is adapted both to principal equipment and auxiliaries in refineries, gas plants, pipe-line substations, etc. As many as 24 bearings can be monitored from each central control cabinet. Electrical resistance bulbs, each only 0.215 in. in diameter, are mounted in a small hole drilled in each bearing. Only the bulb tips are temperature-sensitive and, because these tips are located in direct contact with bearing very close to the actual inner-bearing surfaces, existing bearing temperatures and their fluctuations are sensed rapidly. Temperature of each bearing is checked automatically every 2 minutes. If, when checked, temperature of any bearing exceeds an established maximum (which may be different for each bearing), an alarm is sounded to call an attendant. Overheated bearing is identified by an indicating lamp on central control cabinet panel. Attendant reads actual temperature of any bearing by plugging into appropriate jack an electrical thermometer which is built into central control cabinet panel. *Instrument Division of Thomas A. Edison, Inc.*


BEARING HOUSING
ANGLE A TO BE SUCH AS TO BRING ELEMENT TIP TO HOTTEST SPOT ON PERIPHERY OF BEARING
BRONZE BUSHING
SHAFT
TEMP. SENSING ELEMENT (RESISTANCE)
A

IT'S NEW CHECK IT

(11) PORTABLE LIGHT TOWER provides adequate illumination for night operation in oil fields, pipe-line construction work, and around refineries and natural-gasoline plants. Two floodlights atop an 18-ft. steel tower are pivot mounted with adjustable beam and spread. Current is supplied by a gasoline-powered generator stationed in the all-steel body of the Bantam utility trailer. Design of trailer enables perfect balance either when stationary or being pulled behind tractors, trucks, or passenger cars. Gross weight carried by trailer is 800 lb. *Arrow Supply Co.*

IT'S NEW CHECK IT

TRADE LITERATURE

(12) HANDLING, SAMPLING AND TESTING OF FATTY ACIDS covers the following subjects: Storing fatty acids, pumping fatty acids, process equipment, standard

sampling methods and equipment, testing fatty acids, and tests commonly used and their meanings. Color conversion chart included. *Armour Chemical Division, Armour & Co.*

IT'S NEW CHECK IT

(13) BUSHING STOCK. Long-range service with a minimum of maintenance and cost is theme of four-page folder on centrifugally cast tubular and solid bronze bars. Included in description is list of stock sizes for immediate shipment. Illustrated. *Shenango-Penn Mold Co.*

IT'S NEW CHECK IT

(14) PETROLEUM-LABORATORY EQUIPMENT. Cloud and pour-point test cabinets and distillation apparatus for petroleum products are covered in four-page pamphlet. Each unit illustrated and dimensions given. *King Refrigeration Co.*

IT'S NEW CHECK IT

(15) POWER-UNIT CATALOG gives to power users an up-to-date knowledge of complete line of manufacturer's gasoline and diesel engines and power units available in a wide range of from 3 to 400 hp. Pertinent information is given to assist user in choosing the most suitable power for his particular application with a section devoted to accessories, power take-offs, and reduction gears. *Hercules Motors Corp.*

IT'S NEW CHECK IT

(16) WIRE-ROPE CLAMPS. New color leaflet illustrates and describes new type wire-rope clamp which eliminates slow expensive splicing jobs and yet provides positive strong locking. Emphasizes ease of assembly. *Cabl-Ox Corp.*

IT'S NEW CHECK IT

(17) KANTI-LEVER FLEXIBLE COUPLINGS. New eight-page bulletin punched for ring binding, describes flexible coupling that cushions motor and driven machine against the effects of shock loads, corrects misalignment, and gives protection against destructive overloads. Illustrations, dimension tables, and price list accompany description. *Brown Engineering Co.*

IT'S NEW CHECK IT

(18) WIGGINGS FLOATING ROOF. New 20-page, 3-color bulletin explains how the Wiggins Hidels floating roof hermetically seals the liquid surface in a storage tank thereby reducing standing and pumping evaporation losses to a minimum. Structural details and blueprint plan views included. *General American Transportation Corp.*

IT'S NEW CHECK IT

(19) WELDING AND CUTTING EQUIPMENT. New 20-page catalog shows in 4-color illustrations a comprehensive portion of large line of manufacturer's gas-welding and flame-cutting apparatus. Material includes description, outstanding features, and prices. *Victor Equipment Co.*

IT'S NEW CHECK IT

(20) CORROSION ALLOY GUIDE. A "Guide to Selection of Durco Corrosion Resisting Alloys" lists 155 corrosives in alphabetical order and shows which of five Durco alloys offers most satisfactory resistance to each corrosive. By means of an "A, B, C, D" code the relative ability of each alloy is shown for each corrosive service. *Duriron Co., Inc.*

IT'S NEW CHECK IT

(21) NEW HENDY CRANE. Oil-field equipment houses and drilling contractors will find a legion of uses for handy, fast, and powerful Johua Hendy type U crane, described in new four-page bulletin. Machine is ideal for handling derrick members, heavy casing loads, drilling and pumping equipment, and servicing equipment. *Industrial Equipment Co.*

IT'S NEW CHECK IT

(22) SELECTION AND APPLICATION OF TRUCKS. All companies and individuals concerned with truck operation will be interested in this pertinent discussion covering the proper selection and application of trucks. The 19-page presentation is divided into eight steps or procedures arranged in the order in which they should be considered to answer all the questions of truck application. *White Motor Co.*

IT'S NEW CHECK IT

(23) CALOROPTIC B.T.U. INDICATOR, for natural, artificial, mixed, propane, or butane gas, determines the heat value of gas in B.t.u. without any log, correction, or calculations. New four-page bulletin gives application, description and accuracy of this gas-check system. *Connelly Iron Sponge & Governor Co.*

IT'S NEW CHECK IT

(24) INDUSTRIAL PACKING. A few of the most frequently used metal packings and rings are described and illustrated with cross-section drawings in new two-color folder. Types covered are inside case packings, outside case packings, inside annular packings, CO packing, and packing rings, wiper rings, and piston rings. *France Packing Co.*

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REFINING

Socony-Vacuum Sets Up Jet-Power Test Unit

NEW YORK.—A transparent combustion unit in which flying altitude conditions simulate 60,000 ft. above sea level, has been established in the laboratories of Socony-Vacuum Oil Co., Inc., at Paulsboro, N. J. In this and other units the company is giving increased attention to fuels for jet-powered engines.

Unlike most war activities, this field has gained impetus since V-J Day. Since only about 10 per cent of the total available energy in jet fuels is now utilized for flying power, it is obvious that much research remains to be done.

A single complete power unit, consisting of a compressor, turbine, and single-tube combustion chamber is under construction by Socony-Vacuum and will be completed shortly.

This unit will maintain flight conditions, including turbine speeds up to 20,000 r.p.m., and with turbine blades operating under essentially the same conditions as found in flight. Major problems under immediate study include range of combustion of flame stability; completeness of combustion and carbon deposition, and fuel availability. A generally satisfactory fuel developed recently has the disadvantage of a freezing temperature higher than —76° F., the present specifications standard.

Low carbon depositing tendencies are of great importance, engineers point out, since the result is better flight efficiency, less danger to turbine blades and the whole power unit from dislodged flakes of carbon and less downtime for overhaul.

Jet engines now in use can use either kerosine or high-octane aviation gasoline if proper modifications are made in the unit to suit each fuel. Both types usually have good flame-stability properties, i.e., they do not blow out under most flight conditions. Another important item in fuels is that of leaving no smoke or flame trail in flight, which may prove important to military planes in war.

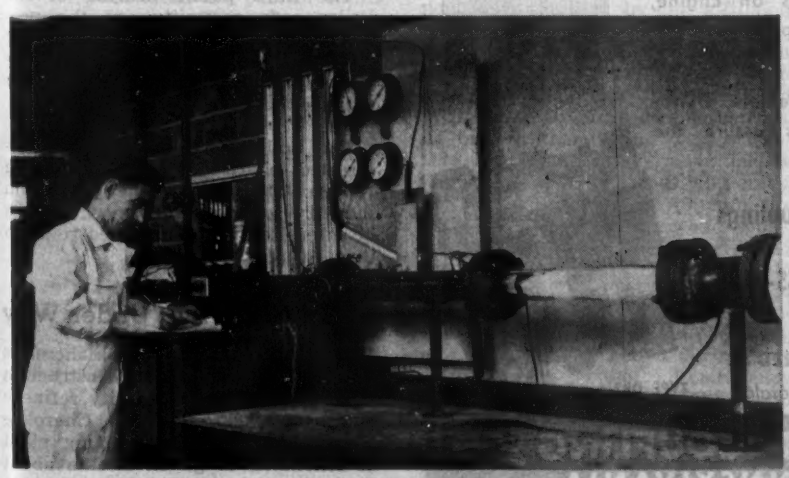
Petroleum is considered the best prospective source for jet fuels. Synthetic products from Fischer-Tropsch or simliar processes yield essentially petroleum products. Alcohols are inferior to hydrocarbons as jet fuels.

Ashland Enters Only Bid for U.S. Plant

Sole bid for the purchase of the Government-owned aviation-gasoline plant adjacent to Ashland Oil & Refining Co.'s Catlettsburg, Ky., refinery has been made by Ashland.

The company offered $2,153,125 for the property with a cash payment of $653,125. The remainder would be paid in 30 quarterly installments with 4 per cent interest. Ashland would spend $800,000 in repairs, maintenance, and improvement the next 18 months. Final action by War Assets Administration on the offer is expected to take about 3 or 4 weeks.

The plant was operated by Ashland during the war. Subsequently



Socony-Vacuum's new combustion unit for research on jet fuels

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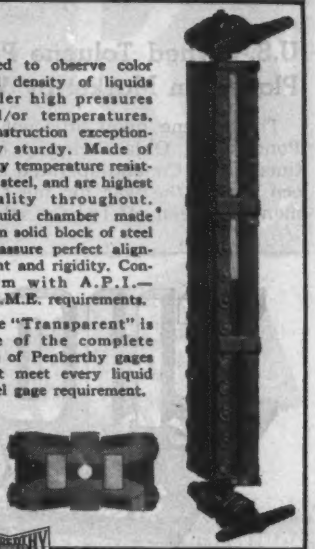
"TRANSPARENT"
DROP FORGED STEEL
LIQUID LEVEL GAGES

Used to observe color and density of liquids under high pressures and/or temperatures. Construction exceptionally sturdy. Made of alloy temperature resisting steel, and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Transparent" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.



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INDUSTRIAL
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BURNING
EQUIPMENT
NATIONAL AIROIL
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the company took a 1-year experimental lease to determine commercial feasibility of conversion of the property. The plant includes a 10,000-bbl. capacity Thermofor catalytic cracking unit, gas-concentration, alkylation, and isomeration facilities. Ashland's Catlettsburg refinery has a crude charge capacity of 22,000 bbl. daily.

U.S.-Owned Toluene Plant Placed on Market by WAA

The toluene plant adjacent to the Ponca City, Okla., refinery of Continental Oil Co. and operated by Conoco during the war for the Government has been offered for sale, lease or removal. Bids were received by War Assets Administration until September 22.

The plant has a toluene capacity of 700 to 1,100 bbl. daily.

Lubricant Additives Is W.P.R.A. Meeting Topic

"Lubricant Additives" will be the subject of a paper by J. H. Baird, Lubrizol Corp., Cleveland, Ohio, at the Western Petroleum Refiners Association fall regional technical meeting October 24 in El Dorado, Ark. Floor discussion will follow presentation of the paper.

Chairman of the meeting, in which new developments in the lubricating-oil and gear-lubricant field will be covered, is A. W. Trusty, Arkansas Fuel Oil Co., Shreveport.

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ALL METAL
SPECIFIED WHEREVER 100% DEPENDABILITY IS DEMANDED

Refiners specify Thomas "Flexible" Couplings for PUMPS, COMPRESSORS, COAL PULVERIZERS, COOLING TOWERS and GENERATOR SETS.

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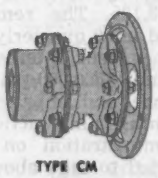
Pipe Line Men know that Thomas "Flexible" Couplings on their Low or High Speed Pumps give 100% dependable service.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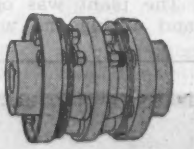
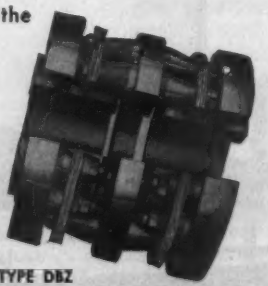
Drilling Engineers get the most out of their equipment with Thomas "Flexible" Couplings on Engine, Gear and Mud Pump Drives.


TYPE DBZ-B

In the Laboratory Thomas "Flexible" Dynamometer Couplings assure the greatest accuracy.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Thomas Flexible All-Metal Couplings Have No Wearing Parts.
BACKLASH, FRICTION and CROSS-PULL ARE ELIMINATED.

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THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

Universal Will Design Ohio Standard's Lima Unit

Building plans for the Standard Oil Co. (Ohio) new fluid catalytic cracking unit and gas-recovery system at its Lima, Ohio, refinery are moving toward completion with the recent placing of designing plans with Universal Oil Products Co.

The contract for the project, which is expected to take 2 years, has been awarded to Arthur G. McKee Co., Cleveland. The unit is being designed for wide flexibility in operation to make possible the processing of a variety of stocks and is expected to produce 30 per cent more gasoline per barrel than is now recovered.

Installation of these facilities is part of an extensive program for modernization of the company's refineries.

Shell Chemical Orders 36 Glycerine Tank Cars

Shell Chemical Corp., San Francisco, has ordered 36 new all-aluminum 8,000-gal. tank cars for transporting synthetic glycerine, according to American Car & Foundry, who booked the order.

The tanks are to be of all-welded construction and equipped with eight lines of 2-in. heater coils and have all-welded underframes. All-welded seams are to be checked by X-ray method to assure flawless welds.

The cars will be built at the American Car & Foundry Milton, Pa., plant.

Boiler-Code Hearing Set for November 19

The third public hearing of the boiler code committee on the proposed revision of Section 8 of the American Society of Mechanical Engineers Boiler Construction Code will be held November 19 in New York.

The Boiler Code Committee is interested in attracting to the meeting representatives from the petroleum industry so that all those who might be interested in the proposed revision may express their views.

East Texas Plant Under Way

Dobbs Refining Co. of Oklahoma is reported to have begun construction on a new 2,500-bbl.-capacity refinery south of Jacksonville in Cherokee County, Texas. The skimming plant is scheduled to go on stream about December 1, using East Texas crude oil.

PIPE LINES

Cities Service Contracts For Ulysses, Kans., Station

The first step in a $36,000,000 pipeline project of Cities Service Gas Co. was announced September 17 by S. B. Irelan, president.

First phase of the undertaking is the building of a modern residential community and construction of compressor-station facilities located near Ulysses, Kans.

Erection of 51 bungalow-type cottages, a community house for employe recreational affairs, a large office building, garages and utilities, costing over $500,000, has been contracted by Whitmor Home Builders.

The construction of concrete foundation structures for the main compressor-engine buildings, an auxiliary building for power generation, machine shop, and other equipment and the gas-dehydration tower has been contracted by Sherwood Construction Co., Independence, Kans.

Total cost of all facilities at the new compressor-station community in the Kansas-Hugoton field alone will be more than $5,000,000, according to company estimates.

Plans call for the initial installation of 17,600-hp. from 11 compressor engine units of 1,600-hp. each, and a delivery capacity of 240,000,000 cu. ft. of gas daily by the end of 1948. Between 1948 and 1950 the company will add compressor-station capacity to bring the total installed horsepower to 46,400 from 29 engine units.

The facilities for which contracts have just been let, with others to be awarded later, are part of a program to increase Cities Service Gas system capacity by an eventual daily total of 370,000,000 cu. ft. through a 400-mile, 26-in. natural-gas pipe line extending from the Kansas-Hugoton field across Kansas.

Total cost of the project at completion will be approximately $36,000,000, according to Irelan.

Erection of the 51 homes for station workers, together with a community house and office building, is expected to be complete within 6 months. The residence buildings are single-story type of two and three-bedroom prefabricated design, with individual garage, full basement, gas, electric and water utilities.

Streets through the new townsite are plotted in curved design similar to the most modern suburban development. The new village will have its own water, gas, and telephone systems. A sewage disposal plant will be installed.

The community house is designed to accommodate employes and their families when social or recreational programs are scheduled. Ultimately the entire site will be attractively landscaped.

Columbia Gas Installing Extensive Radio System

AN investment of $200,000 extending through 1951 by the Pittsburgh group of affiliated gas companies in the Columbia Gas system for a short-wave radio network within a five-state area will improve natural-gas service for the customers of the Manufacturers Light & Heat Co.

Application has been made to the Federal Communications Commission for construction permits to establish short-wave sending and receiving stations.

Plans call for immediate construction of an initial group of transmitters. Emergency radio communication by the gas company will be on a requested assignment of 33.34 megacycles, in the 30-40-megacycle channel of frequency modulation reserved for power-utility services.

Network Employment

The radio network will be employed to improve the dispatching, control, and operation activities related to more than 10,000 miles of natural-gas production and transmission lines operated by the affiliated companies.

Major use of radio communication will be to link the offices of field superintendents and their scattered work crews in times of emergencies. At present there is no way for supervisors to quickly communicate with crews at work in outlying areas, nor for such gangs to communicate with gas company offices and shops.

Tentative plan of the affiliated companies in the Pittsburgh group is to establish in 1947 a few fixed and mobile units in western Pennsylvania. As these swing into operation, new units will be added during succeeding years. By 1951, an emergency radio communication system should adequately cover the various gas-company territories in Pennsylvania, Ohio, New York, West Virginia, and Maryland.

The first of the permanently lo-

CRC
PIPE LINE CONSTRUCTION EQUIPMENT
CRUTCHER-ROLFS-CUMMINGS
Pipe Line Equipment and Materials
Houston-Tulsa

ANDERSON BROTHERS
Pipe Line
Contractors and Engineers
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PENBERTHY
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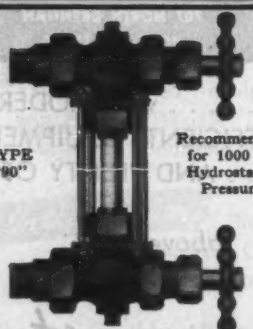

Made of Chromium-Molybdenuin alloy temperature resisting steel, extra heavy throughout and stainless steel trimmed. Positive automatic shut-off; stainless steel balls shut off the flow of liquid if glass breaks. Regrinding removable seats, heavy duty stuffing boxes, union connections. Conform with A.P.I.—A.S.M.E. requirements.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

cated sending and receiving short-wave sets will be located on gas-company property at Hickory in Washington County, Pennsylvania, at Ellwood City in Lawrence County, Pennsylvania, and in Elk County. near Kane, Pa. An 80-ft. antenna mast will be erected at each of these stations.

These fixed stations will operate with an output power of 250 watts. They will be used for emergency communication with 15 mobile, 35-watt stations to be installed on superintendents' cars and work crew trucks.

When the network is fully established, there will be 12 fixed stations at offices and shops, each having 250-watt output; 19 fixed stations of 50-watt output; 5 portable stations of 35-watt output for emergency field installation, and 100 mobile sets for sending and receiving from gas-company cars and trucks.

After the first three western Pennsylvania short-wave radio stations are established, the gas company plans to fill in and expand the network to the north and east.

New stations are tentatively scheduled to be located at Emlenton and Brookville, Pa.; Wellsville, Horseheads, Dundee, Binghamton, Hancock, Unionville, and Tappan, N. Y.

Midwestern Has 35 Miles To Lay for El Paso Line

In the laying of El Paso Natural Gas Co.'s 740-mile, 26-in. Texas-California system, the construction of the western section is nearing completion. This western section, contracted by Midwestern Constructors, Inc., and S-W-D Co., is within 35 miles of being completed. The entire section contracted in this area consists of 220 miles of 26-in. The work will be finished at a point approximately 30 miles east of Blythe, Calif. The project is being supervised for the contractors by W. T. Wilhite.

Midwestern Constructors, Inc., has laid 10 miles of a 51-mile, 24-in. loop for Natural Gas Pipeline Co. of America between Ottawa and Joliet, Ill. Operations are directed from field headquarters at Ottawa by R. C. Stanley. In the Chicago area, an affiliated company, Midwestern Contractors, Inc., is laying 19 miles of 24-in. between the outskirts of Chicago and Joliet for the Chicago District Pipe Line Co. Work is supervised by D. L. Weller, with headquarters at Lemont, Ill.

Michigan-Wisconsin Line To Cost $72,500,000

Construction costs of the first phase of a proposed pipe line to be operated by the Michigan-Wisconsin Pipe Line Co., will approximate $72,500,000 after

LOW-COST INSURANCE
for Your Underground Lines

Combating corrosion of steel pipe in underground service has always been a major problem confronting the industry. Reconditioning or replacing underground pipe is an expensive "solution" because invariably it is more costly than the original installation.

Today, with costs of labor, materials, handling and shipping multiplying this problem, can you afford not to protect the steel pipe you are placing in underground service?

Pipe Line Service offers you low-cost insurance for your underground lines through a complete pipe protection service that leaves nothing to chance. Six strategically located plants provide pipe cleaning, priming, coating and wrapping—furnishing all materials and equipment to avoid division of responsibility and to relieve you of all details on your pipe protection requirements.

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allowing $700,000 for working capital, the Securities and Exchange Commission was told today.

The costs were reported by Ralph T. McElvenny, vice president of American Light & Traction Co., at a hearing on the amended reorganization plan of American Light which provides for the company's continuation as a holding company.

Under the plan, American Light, which is a subsidiary of the United Light & Railways Co., would control Michigan-Wisconsin, the Austin Field Pipe Line Co., the Michigan Consolidated Gas Co., and the Milwaukee Gas Light Co.

Funds to cover the construction program would be acquired by having American Light purchase up to $25,000,000 of the common stock of Michigan-Wisconsin for cash, according to McElvenny. The remainder of the funds would be raised by the latter company issuing $40,000,000 of 20-year first mortgage 3¼ per cent bonds and $7,500,000 of 7-year serial notes.

Great Lakes Using Airplane Engines on Pumps

Great Lakes Pipe Line Co. is installing intermediate booster units between main-line stations. Each of these booster units will be equipped with a centrifugal pump driven by an Allison, 12-cylinder, V-type airplane engine.

At 2,300 r.p.m. the engine develops 870 hp. Through stepup gears it drives the pump operating at 3,550 r.p.m. The pump is a seven-stage type with a daily capacity of 41,000 bbl. through an 8-in. line, against 900 psi. pressure.

The engines have been obtained as war surplus. Some have never been operated; others have not been operated since being entirely overhauled. It is the intention of the company to discard engines as salvage when they become inoperable.

A heat exchanger connected with the refined products line is made in two parts: One cools the jacket warmer coolant; the other cools lubricating oil.

Engine speed is controlled by suction and discharge pressures affecting a diaphragm instrument which actuates the engine's throttle or motor valve.

Each unit is mounted on a frame 22 ft., 10 in. long and 6 ft. 4 in. wide. Total weight of each unit is 20,000 lb. A temporary building of galvanized steel is provided with firewall. The interior is covered with sound-deadening material.

These booster units are to be installed at 12 locations. On one of the three lines of the Barnsdall, Okla.-Kansas City system, these booster units will be located near Caney, Thayer, Selma, and Bonita, Kans. On one of the two lines northeast of Kansas City, these units will be near Paradise, Pattonsburg, Mo., and Lamoni and Indianola, Iowa. On the line northwest of Kansas City, the units will be at Leavenworth and Hiawatha, Kans., Auburn and Ft. Crook, Neb.

Immediately after the war, Great Lakes Pipe Line laid more than 1,200 miles of new line, erected 10 new terminals and modernized existing facilities to increase operating capacity 50 per cent.

Stanolind to Open La Plata Loop Bids September 30

Stanolind Pipe Line Co. will open bids September 30 for 74.4 miles of 20-in. looping between the Mississippi River and La Plata, Mo. Work will start about October 15.

Stanolind is running crude oil through the recently completed line from Caprock, N. M., to a connection at Sundown, Tex., with the Slaughter-Drumright 16-in. line.

Panhandle Hearing Reset

A hearing on Panhandle Eastern Pipe Line Co.'s application for construction of $23,464,000 in new facilities at Liberal, Kans., and points east of there, has been postponed by the Federal Power Commission from September 15 to November 12.

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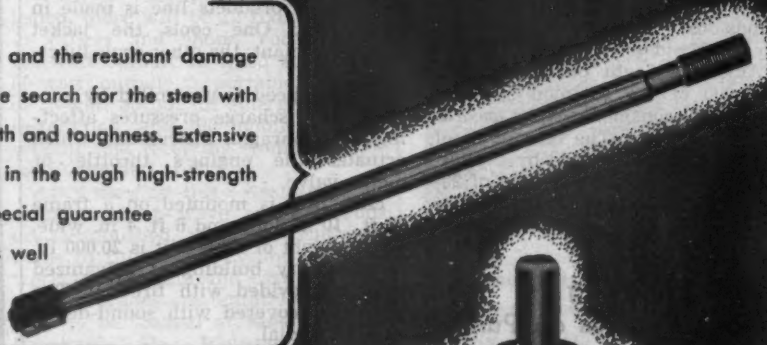
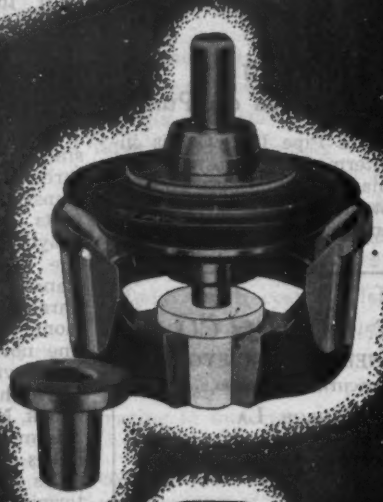
MISSION LEADERSHIP IN
Metallurgy and Heat Treating

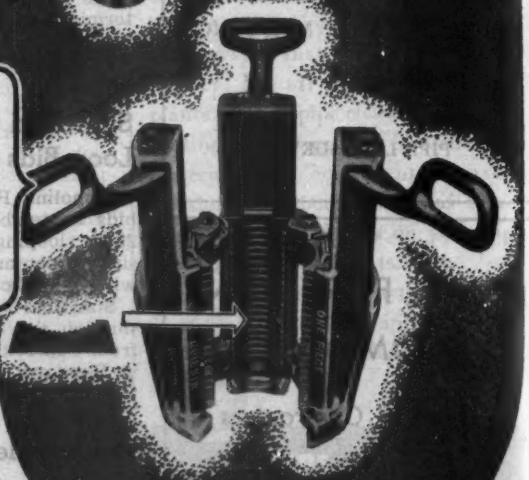
To solve the problem of rod breakage and the resultant damage to pump, Mission instituted an intensive search for the steel with the best possible combination of strength and toughness. Extensive tests by Mission metallurgists resulted in the tough high-strength Mission rod that bears the Mission special guarantee which covers damage to the pump as well as replacement of the rod.



Steel requirements for maximum hardness differ from those for maximum toughness. The Mission Silver Top Valve design permits making the wear-taking bushing for maximum hardness and the valve seat for maximum toughness. This results in better valve service for Mission customers.



Mission metallurgists experimented with hundreds of combinations of steel and heat treating to get the greatest practicable hardness of Mission slip dogs. This extreme hardness is your assurance of the long life and positive grip of Mission slips.



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NATURAL GAS

Carthage-Longview 20-In. Line Authorized

A 33-MILE, 20-in. natural-gas transmission line from Carthage field in Panola County, Texas, to near Longview has been authorized by the Federal Power Commission for construction by United Gas Pipe Line Co.

When completed, the line will deliver gas to the Longview, Tex., terminus of the 24-in. line of Texas Eastern Transmission Corp.'s Big Inch system. This gas from United properties will amount to about 100,000 cu. ft. daily. In addition, the line will carry gas into the Dallas district system of United, and move some gas to Texas Eastern from Lone Star Gas Co. and Chicago Corp. properties in Carthage field.

At the same time, FPC authorized construction of a 9-mile, 10-in. lateral linking Lone Star's Carthage field gasoline plant with the new 20-in. line.

Total cost of the project is estimated at $1,730,000.

Oral arguments were scheduled to commence this week in Washington on Texas Eastern's application for a permanent certificate from FPC to operate the Inch system which it purchased from the Government for $143,127,000. A lengthy hearing on Texas Eastern's plans was held last summer. Approval of the certificate by the commission is expected.

Texas Eastern's over-all plans for converting the line to full natural-gas service include the construction of a 2,164-hp. compressor station at the Longview terminus where the new United 20-in. line will end. This Texas Eastern station will have a maximum discharge capacity of about 288,000 cu. ft. daily.

Sid Richardson Buys Odessa Black Plant

An Odessa, Tex., channel-type carbon-black plant operated during the war by United Carbon Co. has been sold for $4,300,000 to Sid W. Richardson, Fort Worth independent oil and gas operator, War Assets Administration announced in Washington.

The plant, one of the largest built by the Government to meet military needs, consists of 670 buildings on 426 acres. It has a capacity of 45,000,000 lb. of carbon black annually.

The property includes 416 burner buildings with sheet-iron coverings, 10 warehouses, miscellaneous smaller buildings of steel frame, burners, scrapers, conveyors, pulverizers, machine-shop equipment, and loading and bagging machinery. Gas for the plant is being supplied at present by Cities Service Oil Co., Odessa Natural Gas Co., and two Phillips Petroleum Co. plants. United Carbon's lease on the properties expires January 1.

In Fort Worth, Richardson, who has large gas reserves in the vicinity of the plant, was said to be planning no major changes in operation or personnel of the plant. When he takes over, W. F. Matheny, manager of the natural-gasoline and gas department of Richardson & Bass, Fort Worth, will be in charge.

Three offers for another government carbon-black plant, that at Eunice, N. M., were opened by the WAA last week in Denver. They were from Panhandle Carbon Co., present lessor; Columbian Carbon Co., and United Carbon Co.

Varied Program Planned For I.N.G.A.A. Meeting

A VARIETY of subjects of interest to executives and technical leaders in the natural-gas industry are scheduled for discussion October 24 at the third membership meeting of the Independent Natural Gas Association of America at the Skirvin Hotel in Oklahoma City.

The outlook for the supply of steel pipe, synthetic fuels, and problems of independent producers are among the topics of papers to be presented at the 1-day meeting.

The program for the meeting follows:

FRIDAY, OCTOBER 24

9:15 a.m.—Board of directors breakfast and business meeting.

9:30 a.m.—Address of welcome from Roy J. Turner, Oklahoma governor; president's report, Joseph Bowes, president, Oklahoma Natural Gas Co., Tulsa; "The California Line—Economic and Physical Problems Incident Thereto" (with motion pictures), Paul Kayser, El Paso Natural Gas Co., Houston; question-and-answer forum on "The Steel Pipe Outlook," W. F. McConnor, vice president, National Tube Co., Pittsburgh; report of the legal committee on current problems, Glenn Clark, general counsel, Cities Service Gas Co., Oklahoma City.

12:30 p.m.—Business luncheon, report of the nominating committee and election of directors, report of the executive director, John A. Ferguson, Washington.

1:30 p.m.—"The Problems of the Distributing Company as Related to Producers and Transporters," R. G. Taber, president, Atlanta Gas Light Co., Atlanta; "A Royalty Owner Looks at the Gas Industry," James F. Gray, Dallas; "Gas for Tomorrow," Gail F. Moulton, staff geologist, petroleum department, Chase National Bank, New York; "Synthetic Liquid Fuels and Chemicals from Natural Gas," George Roberts, Jr., research division, Stanolind Oil & Gas Co., Tulsa; "Some Operating Problems of the Independent Producer," L. T. Potter, assistant to the president, Lone Star Gas Co., Dallas.

5 p.m.—Board of directors meeting and election of officers.

5:45 p.m.—Membership party.

Gas Service Completing Purchase of Interstate

Gas Service Co., Missouri-Kansas distribution affiliate of Cities Service Gas Co., will complete its acquisition of Interstate Gas Co. when final approval is given by the Federal Power Commission for the purchase of the two gas transmission lines involved.

Earlier this month, the Securities and Exchange Commission authorized the company to buy Interstate's outstanding stock for $1,200,000 from Wallace and Helene D. Gilroy, Kansas City, Mo.

The two pipe lines, for which purchase approval will be asked of FPC, are about 23 miles long, extending from Holden and Pleasant Hill, Mo., and from Harrisonville, Mo., to a junction with Panhandle Eastern Pipe Line Co.'s main line. These lines will be resold by Gas Service to Cities Service Gas for $90,000.

The distribution system purchased by Gas Service serves some 10,000 customers in 36 communities in Missouri and Kansas, mostly in the area south and southeast of Kansas City.

Natural Gasoline

Butane-Propane Group Elects New Officers

John M. Robinson, Butane Gas Co., Woodworth, La., was reelected president of the National Butane-Propane Association at its second annual meeting in St. Louis September 15-17.

Protest against serving new foreign markets, further exportation of butane or propane or the use of tank cars for that purpose, were made at the meeting.

Other officers elected include: John L. Locke, Northwestern Blaugas Co., and R. N. Short, Red Devil Butane Gas Co., first and second vice president respectively; Harry H. Torbit, Union Gas & Equipment Corp., elected a vice president and reelected treasurer.

Forged Steel Swaged Nipples

Forged Steel Bull Plugs

Forged Steel Welding Reducers

Forged Steel Welding Caps

FORGED STEEL SWAGED NIPPLES

Of Standard, Extra Heavy and Double Extra Heavy Seamless Pipe. Precision threads eliminate galling, seizing. Norrisized (anti-corrosion treatment); inspected five times during manufacture. Labeled with pipe and thread sizes.

FORGED STEEL BULL PLUGS

Of Standard, Extra Heavy and Double Extra Heavy Seamless Pipe. Triple-thick nose adds extra strength. Norrisized (anti-corrosion treatment); inspected five times during manufacture. Labeled with pipe and thread sizes.

FORGED STEEL WELDING REDUCERS

Of Standard, Extra Heavy and Double Extra Heavy Seamless Pipe. Very close tolerances in length, O. D. and I. D. dimensions. 37½° uniform bevels on both ends. Lacquer finished.

FORGED STEEL WELDING CAPS

Of Standard, Extra Heavy and Double Extra Heavy Seamless Pipe. Very close tolerances in O. D. and I. D. dimensions. 37½° uniform bevel. Lacquer finished.

Special Bulletin 31-A contains complete information. Write for your copy!

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Exploration and Drilling

Deep Cretaceous Oil in Wyoming

INNER basin wildcatting, at least in the Big Horn basin in Wyoming, looks more attractive now as a result of the discovery of light, sweet crude in the Third Frontier sand (Cretaceous) at General Petroleum Corp. 45-26 Government, NE NE SW 26-46n-91w, on the South Sand Creek structure in Washakie County.

This test, started as a 10,000-ft. test to the Pennsylvanian Tensleep sand, has been completed at 6,753 ft. in the Third Frontier sand topped at 6,690 ft., total depth 6,753 ft., with 9⅝-in. casing cemented at 6,690 ft., and 2-in. tubing at 6,707 ft.

On one 23-hour test, through ½-in. tubing choke, the well flowed 587 bbl. of 48.5°-gravity oil net, cut 0.4 per cent, with 1,450,000 cu. ft. of gas, casing pressure 900 psi., tubing pressure 300 psi., trap pressure 90 psi., gas-oil ratio 2,470 cu. ft.

On another test, 24 hours, through a 13/64-in. tubing choke, the well flowed 267 bbl. of 48.2°-gravity oil net, cut 0.1 per cent, with 627,000 cu. ft. of gas, casing pressure 1,680 psi., tubing pressure 800 psi., trap pressure 70 psi., gas-oil ratio 2,348 cu. ft.

These tests show that the sand is definitely producing oil, and not condensate. This fact is of more significance than might first appear. When the operators first started stepping out from the rims of the basins to drill deep tests, one of the primary objectives was the prospect of finding light, sweet crude in the Cretaceous sands at not too great depths.

Up until General Petroleum's discovery, this objective had received setbacks. The Cretaceous sands had either been dry, contained gas, or showed for condensate producers on drill-stem tests. These setbacks were offset by success in finding deep Tensleep (Pennsylvanian) oil, and the discovery that while such oil was still sour crude, the gravity was substantially higher and the sulfur content considerably lower than the black Tensleep oil found in rim structures.

Drilling for condensate in the Rocky Mountain area at depths of 7,000 ft. or more was definitely not an attractive proposition at this time. That seemed to leave only Paleozoic prospects for inner-basin tests. These prospects had turned out pretty good so far, but it meant 10,000 to 14,000-ft. wildcats with only one or two deep formations as possible producers. The new discovery shows that at least in some places there is a chance of finding high-gravity, sweet crude in the Cretaceous; as well as the pretty good prospects in the Paleozoics for not too low gravity and not too high sulfur-content crude.

This new discovery, coming on the heels of development in the Madison lime pay at Elk Basin (see The Oil and Gas Journal, September 20, 1947, page 333), should add still more stimulus to the Rocky Mountain interest, which is already at an all-time high pitch. It is estimated that seismograph work in that area this year has been about 40 per cent higher than last year, and last year was probably the highest record up to that time.

Recent announcements by Stanolind Pipe Line Co. of expansion projects in the Rocky Mountain area (see The Oil and Gas Journal, September 13, 1947, page 136) point to an increasing outlet for Rocky Mountain crude in the Middle West. Apparently the crude market in the Chicago region is to be supplied in part by increased supplies from the Rocky Mountain area, as well as larger supplies from West Texas.

This development should bring about an interesting condition in relative crude-oil prices. West Texas oil will be moving competitively both to the Gulf Coast and to the Chicago area. That means that West Texas oil laid down on the coast will influence the price of all other crudes that reach the coast, and vice versa. But West Texas oil moving into the Chicago area will have the same effect on all sources of crude moving to that market, and vice versa. With Rocky Mountain surplus oil moving to Chicago, all crudes east of the Rockies will be in direct competition, and direct price comparisons and standard published transportation charges available. Should the rumored oil pipe line from West Texas to California materialize, some day all crude-oil regions in the United States will be subject to direct price comparisons.

All crudes are now in competition but the comparisons must be indirect, through overlapping competitive marketing areas for refined products, and this gets complicated by considerations of refining costs and especially of varied transportation costs for different products, by different method of transportation. It looks as though in the future direct comparisons involving only posted crude prices and posted pipe-line tariffs will be available.

TEXAS GULF COAST

New Oil Pool Opened In Matagorda County

HOUSTON.—Stanolind Oil & Gas Co. 3 C. J. Anderson, wildcat approximately 1¼ mile east of Lucy field production, Matagorda County, has opened a new oil pool. Drilled to a total depth of 10,800 ft., with 7-in. casing cemented to 9,796 ft., this well produced 37°-gravity oil and gaged 194 bbl. daily through a 3/16-in. choke with 620 psi. flowing pressure on the tubing and 1,180 psi. casing pressure. A test through perforations at 10,160-168 ft. flowed salt water with a slight show of condensate and 2,100 psi. gas pressure. Prior to pipe setting a drill-stem test of a section 8,548-74 ft. recovered 4,800 ft. of 36.8°-gravity oil and no water.

George R. Brown and Standard of Texas 1 Earl Hankamer, wildcat oil discovery on the Gist Prospect in the southwestern corner of Newton County, on initial test flowed 35 bbl. of oil in 13 hours through a 3/32-in. choke with 1,400 psi. flowing pressure on the tubing and a gas ratio of 1,700. Total depth is 7,354 ft., and production is through perforations at 5,743-45 ft. Operators are preparing to make a potential gage after building tank storage space.

Grubb & Hawkins and Jack W. Frazier 1 J. R. Farmer, discovery well in the Clodine area, 1½ miles southwest of Clodine field in Fort Bend County has been dual-completed and is shut in waiting on separator and storage facilities. Tubing completion is through perforations at 7,415-20 ft. where the well flowed dark-colored 45°-gravity condensate and gas and has a shut-in pressure of 2,900 psi. The casing completion is through perforations at 7,260-64 ft. where it flowed water-white condensate, gravity over 50°, and has a shut-in pressure of 2,400 psi. Total depth 7,665 ft.

Ohio Oil Co. 1-B Nada Unit, W. S. Delaney Survey 4, extension and new sand opener at Nada field in Colorado County, flowed on potential gage 87 bbl. of condensate an 335,000 cu. ft. of gas per day with 1,525 psi. tubing pressure and 1,700 psi. on the casing. Open flow calculation is 6,500,000 cu. ft. daily. Production is from new sands with perforations at 6,216-20 ft. Regular field sands showed salt water on test.

TEXAS GULF COAST SUCCESSFUL WILDCATS

Goliad County: New oil pool, Brandt—Sunray Oil Corp. 1 George H. Brandt,

in Thos. Hancock Sur., 3 mi. NE of Weesache and 1½ mi. NW of Weser field, in north corner of county, top pay 7,706 ft. Luling sand, TD 8,513 ft.

TEXAS GULF COAST WILDCAT FAILURES

Bee County: PLD Well Service Co. 1 I. F. Welder, J. N. Planes Sur., 4½ mi. E'ly from Beeville, dry, TD 4,425 ft.

Brazoria County: J. S. Abercrombie and Atlati Royalty Co. 1 Walter O. Caldwell, Jr., in J. Thompson Sur., 2 mi. E of Pledger, dry, TD 10,248 ft.

McCarthy Oil & Gas Corp. 1 Giesecke et al, in J. H. Bell Lge., West Columbia area, dry, TD 10,350 ft.

Rowan Drlg. Co. and Texas Gulf Production Co. 1 Mrs. Lena McIlvaine, in M. O'Donnell Sur., 3 mi. SW of Alvin townsite in Moore Prospect area, dry, TD 10,020 ft.

The Texas Co. 1 E. H. Mayes et al, Geo. Tennille League, West Columbia area, dry, TD 9,646 ft.

Fort Bend County: Woodley Pet. Co. and Sam F. Bashara 2 Sugarland Industries, in Wm. Stafford Sur., dry, TD 7,357 ft.

Cecil Hagen 1 Frank L. Tiller, in Barnabus Wickson Sur., in Big Creek area, dry, TD 6,746 ft.

Galveston County: Miles Prod. Co. 1 Knox B. Howe, in Mary Fabreau Sur., 5 mi. NE of Alvin, dry, TD 7,001 ft.

Goliad County: Ginther, Warren & Ginther 6 Carrie G. Wood et al, in Solon Bartlett Sur., 13 mi. S-SE of Goliad, dry, TD 5,499 ft.

Harris County: Cities Service Oil Co. 2 J. A. Sharman, in W. H. Mowery Sur., 10 mi. NW of Houston, dry, TD 7,504 ft.

H. C. Cockburn 1 M. H. Olson, in Dickenson Putnam Sur., in Friendswood area, dry, TD 6,056 ft.

Live Oak County: Continental Oil Co. 1 Frank Lukasik, in Cameron Co. Scn. Ld. Sur., 2½ mi. NW of George West, dry, TD 8,424 ft.

Live Oak County: Oil Drilling, Inc. 1 Holman Cartwright, in J. Poitevent Sur., 2½ mi. SW of Lagarto, dry, TD 6,750 ft.

Tyler County: American Republics Corp. 2 W. M. Rice et al, in BBB&C Sur., Sec. 9, 6 mi. SW of Spurger townsite, dry, TD 6,403 ft.

Could you get a raise if your company stopped advertising?

Suppose your company were to divide up its advertising appropriation among all its employes—in the form of bonuses, let's say, according to the sales you made or the amount of work you turned out. Would you be better off?

Well, for a while you might be. For a few weeks, or even months, you and your company might coast along on a business-as-usual basis. Plenty of orders on the books. Lots more where they came from. Plus all that advertising money you'd be saving.

Or is "saving" the right word?

If your investment in advertising has paid off, how can you possibly *save* anything by stopping it? The real question is—how much do you stand to *lose?*

Curiously enough, you can't actually see what you're losing—at first. By the time you can, it's too late.

It's too late when some of your old customers begin drifting away. When new ones become harder to convince. When your competitors (who aren't "saving" a dime on *their* advertising) take over business that you have lost by default.

Once that happens, the cost of getting back into your stride may far exceed what was lopped off the advertising schedule in the first place.

There was one manufacturer, for example, who sought to "economize" by stopping all his advertising for two years. At the end of that period, his entire sales force, when asked for recommendations, put advertising at the head of the list as the one thing they couldn't afford to be without. But it takes a lot of advertising effort to overcome the inertia of a stalled selling machine—and the manufacturer eventually had to spend a lot more than he thought he had "saved" to get the machine going again.

There are a *lot* of companies who had to learn this the hard way. The expensive way. But the time for expensive things is not now.

Advertising probably isn't your job. But you may have a voice in it some day, and certainly you have a big stake in it now. Because your company can't grow by *making* things—it can only grow by *selling* them. Advertising is simply selling on a mass-production basis.

Especially when it appears in the right business papers, advertising is the cheapest, the most efficient kind of salesmanship there is. That's because the readers of these papers are all alike in one respect: they comprise the greatest concentration of ambitious, dissatisfied, information-hungry people ever driven by a common interest. In both the editorial and the advertising pages, they look for, and find, the kind of ideas and information that will help them do their jobs better, and get ahead faster.

Call it enlightened self-interest. But isn't that why you yourself read this magazine?

The Oil and Gas Journal

Tulsa 1, Oklahoma

We have an interesting little folder which we think you'd like to see. It's called "What Does *No* Advertising Cost?" You can get your copy by writing to this publication. It's free—no obligation, except maybe to yourself.

CALIFORNIA

Rank Wildcat Begun In Untested Area

LOS ANGELES.—Marin County, north of San Francisco, which has been bypassed by oil prospectors for many years, will be the scene of a wildcat project to be drilled by L. M. Lockhart. Lockhart has made a location on the W. S. Tevis Ranch in the Volinas area on the seacoast about 250 ft. above the high tide line. The location is 7-1n-8w, about 40 miles northwest of San Francisco.

Decision to drill at this point was doubtless influenced by oil seeps which have existed for years in the general area. Shallow wells drilled as early as 1904 indicated that the Monterey shale is a competent source of oil here. There is an asphalt dike about 1 mile southeast of the Lockhart location. Old records reveal that in 1865 the Bolinas Petroleum Co. began operations 5 or 6 miles farther southeast in Arroyo Hondo on the Bolinas Grant, the operator being attracted by asphalt seepages and outcrops. This and a later attempt about 1902 to secure commercial production were, however, failures. The deepest well ever drilled in the county went to about 2,800 ft.

Shell Oil Co.'s attempt to find production below the Stevens sand in the Ten Section field has ended in failure. The company's K.C.L.-A 53-30, which was drilled to 14,000 ft., found the deep Vedder sand commercially unproductive. A series of tests at intervals from 11,750 ft. to bottom produced at best only a small amount of oily mud or water with a trace of oil. This is one of a number of deep Vedder tests in recent years which have failed to find the pay, the search in the Coles Levee field having been similarly unsuccessful.

Successful completion of General Exploration Co.'s extension test of the Newhall-Potrero field should occur this week as recent swabbing operations have produced clean oil at the rate of 200 to 300 bbl. a day. Following rather unimpressive tests, the entire interval between 7,841 and 9,147 ft. was reperforated with the above results. The well, 3 Ferguson, 36-4n-17w, is a joint project with Union Oil Co.

Pacific Western Oil Co. has entered the new deep productive area in the Long Beach field discovered several months ago by Shell Oil Co. and will drill the 1 Stanton in 29-4s-12w, a short distance northwest of Shell's 2 Dolley discovery well. Shell is drilling its second well in the area and General Petroleum Corp. has a well below 6,000 ft. Shell found production just below 10,000 ft.

CALIFORNIA WILDCAT FAILURES

Kern County, Edison area: Caliente Oil Co. 1 Cohn Estate, 12-30s-29e, dry, TD 6,301 ft.

San Emigdio area: Continental Oil Co. L-1 K.C.L., 11-11n-22w, dry, TD 10,424 ft.

Lost Hills area: L. M. Lockhart 1 Kern Property Corp., 20-26s-22e, dry, TD 4,097 ft.

Round Mountain area: J. H. Maurer and Arthur C. Fisher 2 Linda, 11-29s-29e, dry, TD 833 ft. Top Olcese 548 ft.

Arvin area: Western Gulf Oil Co. 2 Di Giorgio, 10-31s-29e, dry, TD 6,468 ft. in schist.

Yolo County, Dunnigan Hills area: The Texas Co. 1 Dunnigan Unit Two, 1-10n-

1w, dry, TD 4,000 ft. Base Capay 2,740 ft.

Santa Barbara County, Gato Ridge area: Barnsdall Oil Co. 4 Magenheimer, 8-8n-32w, dry, TD 4,307 ft.

Goleta area: The Ohio Oil Co. 2 Thomas B. Bishop Co., 6-4n-28w, dry, TD 2,060 ft.

Gato Ridge area: Union Oil Co. 1 Giorgi, 12-8n-32w, dry, TD 4,497 ft.

PERMIAN BASIN

Ector County Has Two Good Strikes

MIDLAND.—Humble Oil & Refining Co. 1 Yarbrough & Allen, Ellenburger discovery in southwestern Ector County 6 miles west of Judkins, on official test flowed 866 bbl. of 40°-gravity oil in 24 hours through ⅝-in. choke. Gas-oil ratio was 706 to 1. Total depth is 10,620 ft. Production was through perforations from 10,596-620 ft., with Ellenburger topped at 10,515 ft. Humble 2 Yarbrough & Allen, diagonal southwest offset to the discovery, was drilling below 2,317 ft. Phillips Petroleum Corp. and The Texas Co. 1 McIntire, Ellenburger strike in northwestern Ector, flowed 125.35 bbl. of 44.5°-gravity oil in 1 hour on a drill-stem test from 8,562-90 ft. through a ⅝-in. bottom-hole choke. Gas-oil ratio was 280 to 1. Gas came to the surface in 5 minutes, mud in 14 minutes and oil in 18 minutes. Recovery, when the drill pipe was pulled, was 5,880 ft. of free oil, with no water. Operator was to deepen to 8,615 ft. and make another drill-stem test with packer set at 8,590 ft.

Pure Oil Co. and Humble 1-E-A E. P. Cowden et al, Ellenburger discovery in the Dollarhide field in southwestern Andrews County, ran a 2-hour and 45-minute drill-stem test from 10,120-170 ft. It started flowing out the water blanket in 41 minutes and clean oil in 68 minutes. It was then tested to tanks for 90 minutes, flowing an average of 54 bbl. of pipe-line oil hourly. Gravity was 44°, and gas-oil ratio was 532 to 1. Ellenburger was topped at 9,990 ft. Operators were drilling below 10,170 ft. The test indicated a northwest extension to Devonian and Silurian production before obtaining Ellenburger pay. Stanolind Oil & Refining Co. 1 Celia A. McCrea, east offset to Humble 2 H. O. Sims, most northwesterly producer in the Nelson (Ellenburger) field in western Andrews County, called the top of the Ellenburger at 10,325 ft., 6,945 ft. below sea level. Drilling had passed 10,409 ft.

Gar-Ter Drilling Co. 1 Weiner - Isabel Vaughn opens a new San Andres pool in Crockett County, 17 miles east of the Todd Deep pool. Pay was topped at 1,495 ft. The test was swabbed at the rate of 300 bbl. of oil daily during a test. On a bailing test it bailed 3 bbl. clean oil hourly, no water. Operator was unable to lower fluid below 800 ft. off bottom.

WEST TEXAS SUCCESSFUL WILDCATS

Andrews County: Fullerton Oil Co. 114 McKean & Eilers, Sec. 14, Blk. A-32, PSL Sur., flowed 16 bbl. oil a day 40.8° gravity, Devonian 8,255 ft., TD 8,602 ft., top pay 8,521 ft., elev. 3,356 ft.

Crane County: The Texas Co. 31 W. E. Connell, Sec. 29, Blk. B-16, PSL Sur., 2 mi. W of Jordan pool, flowed 299 bbl. a day 34.2°-gravity oil, San Andres 3,550 ft., top pay 4,660 ft., TD 9,964 ft., elev. 2,769 ft.

Crockett County: R. B. Phillips 1 Magnolia-Shannon, Sec. 24, Blk. Q, GC&SF Sur., 3 mi. NE Shannon pool, pumped 10 bbl. a day 26.4°-gravity oil, top pay 2,355 ft., TD 2,379 ft.

Gaines County: Honolulu Oil Corp. 1 J. M. White et al, Sec. 404, Blk. G, CCSD&RGNG Sur., 12 mi. W Seminole, pumped 158 bbl. a day 31.5°-gravity oil, Glorietta 5,950 ft., top pay 6,930 ft., TD 7,003 ft., elev. 3,477 ft.

Hockley County: E. Constantin, Jr. 1-A Coble, Lab. 50, Lge. 69, Hardeman CSL Sur., 3½ mi. W Levelland, flowed 630 bbl. 32.4°-graviy oil a day, top pay 4,790 ft., TD 4,855 ft., elev. 3,583 ft.

WEST TEXAS WILDCAT FAILURES

Crane County: Ted Weiner et al 1 University, Sec. 23, Blk. 30, University land, 1 mi. N end McElroy pool, dry in Bentonite, TD 3,650 ft., elev. 2,641 ft.

Schleicher County: J. A. Chapman et al 1 L. Robinson, Sec. 49, Blk. 1, GH&SA Sur., 9 mi. NE Page field, dry, TD 6,512 ft., Palo Pinto 4,523 ft., Strawn 5,400 ft., Ellenburger 6,130 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Two new wildcats for Lea County have been announced. Gulf Oil Corp. will drill a 10,000-ft. test adjacent to shallow production on the extreme south end of the Penrose-Skelly pool. It is 6 La Munion, 766 ft. from the north line and 554 ft. from the east line of 28-23s-37e. It will test the Ellenburger. J. M. Kelley et al will drill 1 Sun-State on a farmout from Sun Oil Co. This is a 5,000-ft. test in the Crossroads area of extreme northeastern Lea, and is 660 ft. from the north line and 1,980 ft. from the west line of 16-9s-37e. This test will seek production in the San Andres, in which a wildcat discovery was recently completed by the Devonian Oil Co.

Stanolind Oil & Gas Co. 1 Southland Royalty Co., 8-21s-37e, 1½ miles north of the closest producer from the lower Permian on the north side of the Drinkard field in eastern Lea County, has been completed to flow 301 bbl. of oil daily. Glorietta was topped at 5,210 ft. and pay at 6,555 ft. It was drilled to 6,684 ft. Cole-Darden Oil Co. 1 Phillips-State, 29-17s-34e, 1½ miles west of the Vacuum pool, flowed at the rate of 30 bbl. of oil hourly during a 6-hour test through open hole from 4,330-4,760 ft. after being acidized with 7,500 gal. It has been shut in for storage. Cole-Darden will drill 2 Phillips-State, a ¼-mile outpost to the discovery.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Chaves County: Atha Exploration Co. 1 Lightcap, 24-7s-28e, 13 mi. E Roswell, dry, TD 2,055 ft., elev. 4,036 ft., San Andres 1,885 ft.

MICHIGAN

Kimball Lake Paces State's Operations

SAGINAW.—Twenty-four completions and 15 new locations were announced for the week in Michigan oil and gas fields. Of the nine new oil wells, four were completed in the growing Kimball Lake Field of Newaygo County, their initial potentions ranging from 320 bbl. to 1,200 bbl. per day. The seven new gas wells are in Clare County. Five of the eight dry holes were wildcats. Contributing to the 3,315 bbl. initial of the new oil wells was one for 360 bbl. in Oceana County's Claybanks pool, two small wells in Arenac County and one each in Tuscola and Bay counties.

Four of the new locations are in the Kimball Lake field, two in Clare County, two in Van Buren, one each in Missaukee, Clare, Oceana, Bay, Montcalm, Arenac, and Allegan counties.

MICHIGAN WILDCAT FAILURES

Allegan County, Manlius Township: James J. McGerry, Tr., 1 L. Kluck, NE SW SW 29-3n-15w, dry in Traverse lime, TD 1,393 ft.

Gratiot County, Pine River Township: H. M. McClure 1 W. Secord, NE SE SE 36-12n-3w, dry in Dundee TD 3,321 ft.

Isabella County, Broomfield Township: Mogul Oil Co. 1 Eldon Marshall, NE NE SW 24-14n-6w, dry in Detroit River, TD 3,761 ft.

Montcalm County, Belvidere Township: Chapman Oil Co. 1 I. Dawes, C SE SE 8-12n-7w, dry, TD 3,840 ft.

Muskegon County, Fruitland Township: H. C. Nelson 1 Joe Kubon, SW NW SW 35-11n-17w, dry, TD 937 ft.

SOUTHWEST TEXAS

New Pool Indicated For Atascosa County

CORPUS CHRISTI.—Humble Oil & Refining Co. 1 Nelle-Gordon-Dinsmoore, prospective new wildcat discovery in the Edwards lime zone, approximately 5 miles east of the Imogene field, in Atascosa County, is flowing oil by heads, making about 2 bbl. per head, testing through perforations at 8,102-06 ft. Total depth is 8,124 ft. The Edwards lime showed gas-condensate on drill-stem tests between 8,003 ft. and 8,084 ft., and oil shows below that depth to 8,114 ft. This well is 6½ miles southeast of Pleasanton, in the BBB&C Survey 1,060.

Humble is still swabbing 2 Edward Matocha, outpost test approximately 1 mile east of 1 Henry, northeast extension oil well in the Navarro sand at the Charlotte field, Atascosa County. This well cored Navarro sand at 5,207-90 ft., and on drill-stem test at that depth recovered 126 ft. of oil in 20 minutes using ¼-in. chokes. Casing was set to 5,210 ft. Production test was run in open hole at 5,210-90 ft.

Magnolia Petroleum Co. 1-A Drought, new gas-condensate discovery in the Wilcox zone in northwestern Duval County, 1 mile northwest of Charamousca field, is running potential gage of the gas-condensate production, showing 1,147 psi. working pressure on 5/16-in. choke. The flow is through perforations at 6,545-65 ft., with total depth at 8,504 ft., and 7-in. casing set to 7,502 ft.

Coastal Refineries, Inc. and M. L. Massingill 1-A Garcia Land & Livestock Co., wildcat test about 1 mile northeast of Texas Co. 1 Doss, recent gas discovery well, approximately 6 miles north-northeast of Sullivan City, in southwestern Hidalgo County, is perforating for production test, after setting casing at total depth of 5,250 ft. This well is located in Porcion 43.

SOUTHWEST TEXAS SUCCESSFUL WILDCAT

Jim Wells County: New oil field—Magnolia Petroleum Co. 103 A. A. Seeligson, in John H. Houghton Sur. 286, 2 mi. W of Seeligson field and 1½ mi. NW of South Haldeman field and 1½ mi. SE of old Premont field, TD 6,010 ft., top pay 5,857 ft. (zone 22), perf. 5,857-62 ft., IP: 144 bbl. oil per day through a ½-in. choke, gas-oil ratio 785, TP 1,220 psi., gravity 42.5°, no water.

SOUTHWEST TEXAS WILDCAT FAILURES

Duval County: Cox & Hamon 1 Ira G. Yates Est., E. N. Gray Sur. 246, 14 mi. NW of San Diego, dry, TD 3,939 ft.

V. G. Schimmel et al 2 Leopoldo Lopez et al, T&NO Sur. 6, 7 mi. NE of Bruni, dry, TD 1,804 ft.

Nueces County: Sinclair Prairie Oil Co. 1 Lamar Folda, in Wm. J. Robertson Farm tracts, 6 mi. SW of Corpus Christi, dry, TD 9,318 ft.

H. R. Smith and W. C. McBride, Inc. and Pan American 1 O. A. Shiflett, in Geo. H. Paul's Subd. of Driscoll Ranch, 3½ mi. N of Driscoll, dry, TD 8,010 ft.

Starr County: Hays, Burke & Daubert & Achning 1 T. B. Slick Estate, Sur. 505, 15 mi. NE of Rio Grande City, dry, TD 4,703 ft.

Sun Oil Co. 2 Eduardo Izaguirre, Jr. et al, in La Sal Colorado Grant, 4 mi. NW of North Sun field, dry, TD 4,751 ft.

Zavala County: Jergins Oil Co. 2 Ike T. Pryor, in Antonio Aguirre Grant, 8 mi. NE of La Pryor, dry, TD 858 ft.

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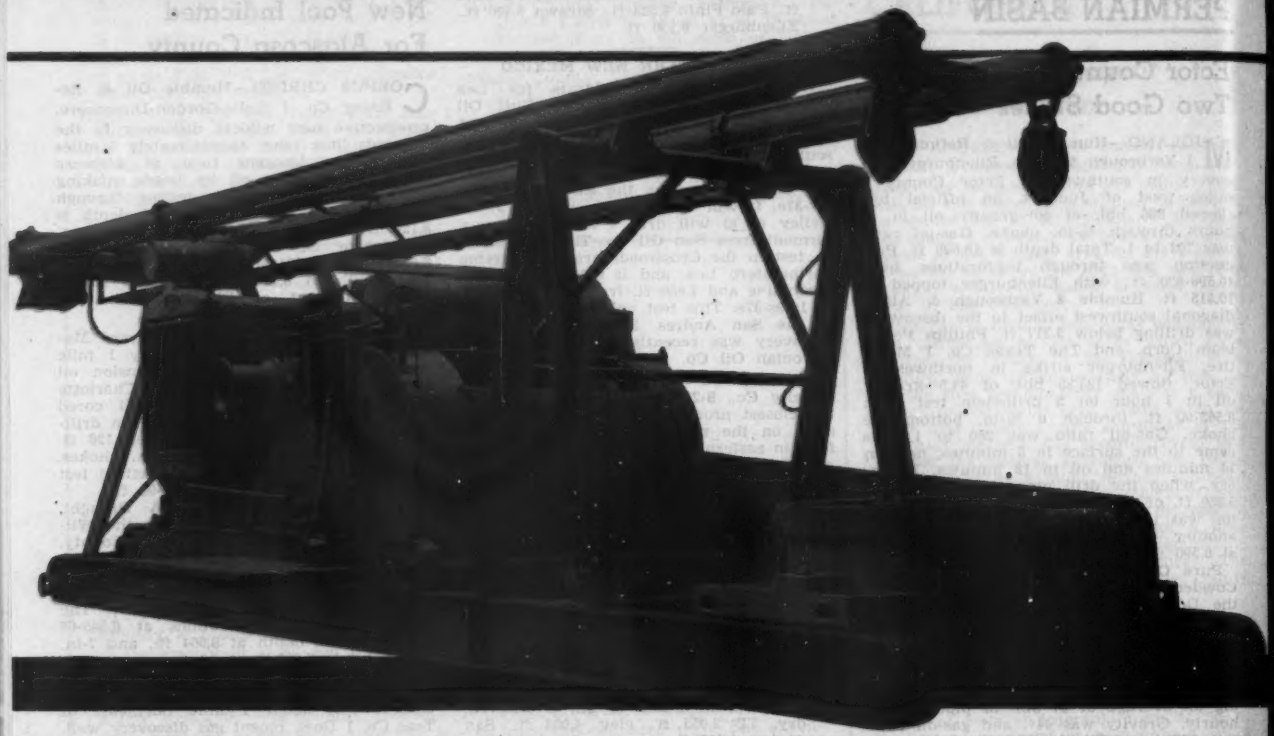

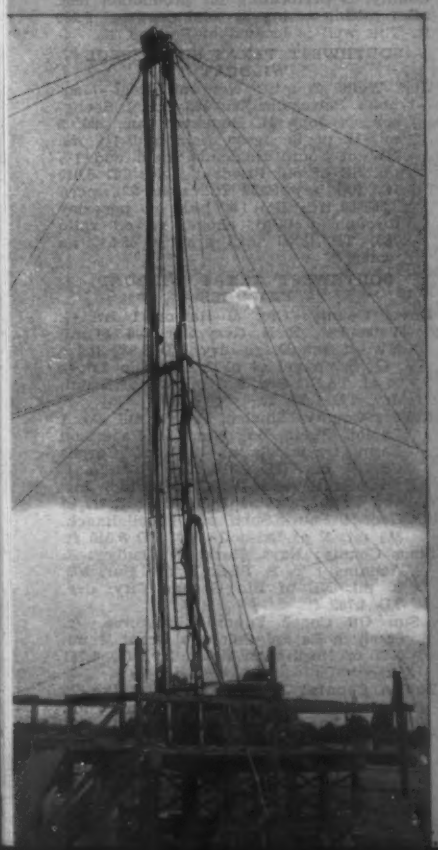

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Model K hoist with 55-foot double leg mast swabbing a 4,869-foot well.

OKLAHOMA

Two New Fields Indicated For Western Garvin County

TWO new oil fields have been indicated by drill-stem tests taken on two western Garvin County wildcats this week. Cities Service Oil Co. is drilling ahead on its 1 Ned Biffle, NW SW NE 23-3n-2w, after two favorable tests. A test at 5,408-40 ft. showed an estimated 2,000 M.c.f. of gas and recovered 90 ft. of distillate and 90 ft. of gas-cut mud, while a second test at 5,437-67 ft. showed an estimated 50 M.c.f. of gas and recovered 360 ft. of oil, 490 ft. of oil and mud, and some water. Both tests were in the Pennsylvanian and current drilling goal is believed to be Viola and Lower Ordovician formations which are productive in East Antioch field, a mile to the northeast.

The other prospective pool opener in Garvin County is Roy Hoffman, Jr., and Shirley Thompson 1 McClain, SW NW NW 25-2n-1w, halfway between Wynnewood and Katie and 4 miles northeast of Katie pool. Drill-stem test of second Deese sand at 4,617-43 ft. recovered 2,000 ft. of oil and some water. Electric log showed no water in the formation and 5½-in. casing was set at 4,680 ft. The Deese was reached at 4,610 ft. and 39 ft. of pay was cut.

Another Anadarko basin test, Stanolind Oil & Gas Co. 1 Briscoe Unit, C NW SE 4-4n-5w, east of Chitwood area in Grady County, cored in Bromide at 13,727-33 ft. and recovered 4 ft. of saturated, porous sand. Drill-stem test is planned.

Woods Drilling Co., New Orleans, has indicated a good field at its 1 Crabtree, NW NE NW 4-16n-1e, a wildcat east of Langston, in east-central Logan County. Test of first Wilcox at 5,165-85 ft. recovered 420 ft. of clean oil and 1,200 ft. of salt water, and second Wilcox was found at 5,236-76 ft. This test is located between the Ramsey Wilcox pool and Coon Creek field.

Republic Natural Gas Co. 1 Harrison, NE SW SE 25-5n-4w, south offset to discovery well of Northeast Lindsay Bromide pool, recovered 900 ft. of 43°-gravity oil, 990 ft. of oily, gassy fresh water, and 90 ft. of oil and gas-cut mud, on drill-stem test at 8,010-48 ft. This test is ½ mile south of Carter Oil Co. 1 Harrison, which has been completed for a natural flow of 884 bbl. of 43.4°-gravity oil.

OKLAHOMA SUCCESSFUL WILDCATS

Jefferson County: Edward et al 1 Carter-Bonner, 21-3s-4w, flowed 5,500,000 cu. ft. of gas per day from sand at 1,625-73 ft. through a ¼-in. choke, sand 545-60 ft., lime 886-990 ft., hard lime 2,514-34 ft., TD 2,608 ft.

Noble County: Warren Petroleum Co. 1 Burgess, NE SE NW 8-21n-1w, flowed 163 bbl. 41.6°-gravity oil per day from sandy dolomite at 5,166-78 ft. through a 16/64-in. tubing choke, Pawhuska 2,215 ft., Avant 3,350 ft., Upper Layton 3,820 ft., Bartlesville 4,781 ft., Mississippian 4,861 ft., Woodford 5,055 ft., Misener 5,108 ft., Viola 5,110 ft., TD 5,178 ft.

Oklahoma County: Harper-Turner 1 Duncan, NE NE NE 16-14n-2w, flowed 12 bbl. of oil per day from Hunton at 5,742-5,805 ft., through a 12/64-in tubing choke, Oswego 5,400 ft., Bartlesville 5,659 ft., TD 5,810 ft.

Pottawatomie County: New pay in St. Louis district—Continental 6 Negahnquit, NW NE NW 19-7n-4e, pumped 15 bbl. of oil per day from Pennsylvanian sand at 3,611-21 ft.; Belle City 2,139 ft., Earlsboro 3,762 ft., Basal Pennsylvanian-Woodford 3,834 ft., TD 3,842 ft.

OKLAHOMA WILDCAT FAILURES

Cotton County: Phillips 1 Belt, SE SE NW 29-3s-11w, dry, TD 1,577 ft., sand 1,547-55 ft. with a show of oil, sand 1,573-75 ft.

E. P. Griffin et al 1 Martin, SW SW SW 36-3s-12w, dry, TD 2,011 ft., sands 1,390-98 ft., 1,475-86 ft. and 1,600-45 ft.

J. W. Baldwin et al 1 Witt, N/2 NE SW 27-3s-11w, dry, TD 1,527 ft., conglomerate 1,251-72 ft.

Haskell County: Coblentz et al 1 Clara Dod, SW SW NW 17-8n-18e, dry, TD 2,076 ft., sand 562-92 ft., shale 592-96 ft., sandy shale 1,743 ft., Hartshorne coal 1,896-1,906 ft., Hartshorne sand 1,906 ft., Atoka shale 2,051 ft.

Hughes County: Harper-Turner and Phillips & McMail 1 Wright, NW NW SW 17-9n-11e, dry, TD 3,107 ft., no tops reported.

Love County: McCurdy & Embry 1 Ward, SW SE NW 9-7s-2e, dry, TD 3,030 ft., Basal Cretaceous 730 ft.

McClain County: Sinclair-Prairie 1 Sparkman, C SE NE 36-5n-3w, dry, TD 8,607 ft., Pennsylvanian sand 6,946-72 ft., Hunton 7,076 ft., Chimney Hill 7,294 ft., Sylvan 7,354 ft., Viola 7,532 ft., Bromide dense 8,018 ft., first sand 8,255 ft., second sand 8,486 ft.

Noble County: Jarrett, Monett & Hale 1 Siler, SE SE NW 34-24n-1w, dry, TD 4,510 ft., Pawhuska 2,110-32 ft., Oread 2,458 ft., Tonkawa lime 2,739-58 ft., Layton 3,475 ft., Oswego 4,025 ft. with a slight show of gas, Cherokee 4,191 ft., sand 4,302 ft. and 4,348-53 ft., Bartlesville 4,389 ft.

Osage County: Johnson Oil & Refining Co. et al 1 Osage, SW SW NW 10-22n-8e, dry, TD 2,824 ft., Cleveland 1,782 ft., Big lime 1,895 ft., Skinner 2,225 ft., Red Fork 2,262 ft., sandy shale 2,365-75 ft., Mississippian 2,495 ft., Arbuckle 2,787 ft.

Seminole County: Mid-Continent 1 Tiger, SW SW SE 13-10n-6e, dry, TD 3,948 ft., Earlsboro 3,230 ft., brown lime 3,681 ft., Gilcrease 3,836 ft., Cromwell 3,858 ft.

Tillman County: Mid-Continent and H. L. Wirick 1 Overton, NW NE NW 33-1s-16w, dry, TD 1,720 ft., no tops reported.

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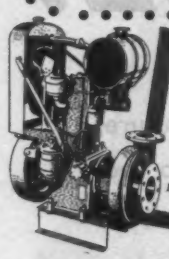

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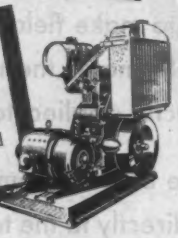

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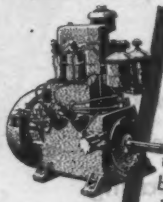

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N. CENTRAL TEXAS

Clay County Oil Discovery Flows 110 Bbl. From Strawn

WICHITA FALLS.—Fain & McGaha 1-A Amos & Andy, J. H. Belcher Subdivision, Block 26, Strawn discovery 2 miles southeast of Deer Creek, Clay County, flowed 110 bbl. of oil in 11 hours through 20/64-in. choke. Pay is from 3,775-90 ft. In the same area, 1 Barrington, same survey, Block 7, missed the discovery sand and is drilling below 4,550 ft. in shale. Fowler Farm Oil Co. 1 Rodgers, 750 ft. from the east line and 330 ft. from the south line of the northwest quarter of Section 14, BBB&C Survey, is a new 2,500-ft. rotary wildcat 2 miles southwest of Charlie.

In Wilbarger County, The Texas Co. 1 Schmoker, Section 9, Block 10, H&TC Survey, wildcat 1 mile southwest of Odell, cored from 6,928-40 ft. and recovered 3½ ft. of lime with a slight show of oil. Later, on a drill-stem test from 6,909-41 ft., open 45 minutes, recovery was 20 ft. of drilling mud with no shows. It was drilling below 6,966 ft. Bridwell Oil Co. 1 White, Section 11, Block 14, H&TC RR Survey, a wildcat northwest of Vernon, is drilling below 2,300 ft. in shale.

Continental Oil Co. 1 W. G. Hawkins, a wildcat in Section 17, H&TC RR Survey, Abstract 362, 4 miles southeast of Ringgold, Montague County, is taking a drill-stem test of a sand section from 5,393-5,405 ft. Top of the sand with stain odor was found at 5,390 ft. Continental 1 J. D. Williams, McKinney - Williams Survey, Abstract 508, a wildcat 8 miles southeast of Bowie, Montague County, was drilling below 6,430 ft. in shale and lime. Barnett was topped at 6,313 ft.

T. J. Waggoner et al 1 Wilson, discovery well in Lot 1, Section 71, ATNCL Survey, 8 miles north of Archer City, Archer County, has been completed to flow at an estimated rate of 200 bbl. daily. It was drilled to 4,405 ft. and plugged back to 3,842 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Archer County: Southern Pet. Explor., Inc. and Chas. E. Morrison 1-D L. F. Wilson, Blk. 71, Lot 1, ATNCL Sur., 8 mi. N Archer City, flowed 98 bbl. 44°-gravity oil 7 hours through 14/64-in. choke, perf. 3,881-3,930 ft., TD 4,405 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURE

Jack County: Continental Oil Co. 1 J. Smith, Sec. 2564, TE&L Co. Sur., A-676, 2 mi. SW Perrin, dry, TD 5,609 ft. Bend 4,819 ft., Marble Falls 4,922 ft., Ellenburger 5,505 ft.

WEST CENTRAL TEXAS SUCCESSFUL WILDCAT

Hamilton County: Lone Star Gas Co. 1 E. L. Riewe, Richard Brown Sur. No. 63, 10 mi. SW Hamilton, initial production 5,182,000 cu. ft. gas a day, Marble Falls 2,584 ft., perf. 2,746-62 ft., TD 3,350 ft., elev. 1,466 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Haskell County: Cities Service Oil Co. 1 Lacy Weaver et al, Blk. 12, Wise Co. School Lds. Sur., 4 mi. NW Rule, dry, TD 6,230 ft., Caddo 5,669 ft., Chester 5,929 ft., Chappel 5,960 ft., Ellenburger 6,140 ft., elev. 1,657 ft.

Parker County: Crader Oil Co. 1 McDonald, Sec. 322, T&P Sur., 1½ mi. SW Garner, dry, TD 3,432 ft., elev. 953 ft.

Throckmorton County: S. D. Johnson and Acme Die & Machine Co. 1 C. O. Turner, Sec. 981, TE&L Co. Sur., 1 mi. E Woodson, dry, TD 4,201 ft., Caddo 3,902 ft.

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SOUTH LOUISIANA

New Gas-Condensate Sand Found in Four Isle Dome

NEW ORLEANS.—Superior Oil Co. of California 2 State-Unit 12, Section 24, 21s-16e, has opened a new deep gas-condensate sand to production, in Four Isle Dome in Terrebonne Parish. Drilled to a total depth of 14,220 ft., after setting 7-in. casing at 14,028 ft., operators plugged back and perforated at 13,467-475 ft. On a 6-hour gage while taking a drill-stem test, the well flowed at the rate of 135 bbl. of 45.2°-gravity condensate daily through a ¾-in. bottom choke and 14/64-in. top choke. Flowing pressure was 4,180 psi. with the gas-condensate ratio 29,900. The test was made in the bottom of a 50-ft. sand section at 13,425-475 ft. A bridge plug has been set above the perforations and operators will test a higher sand.

Atlantic Refining Co. 2 Newport Industries, Inc., is the second producer for the new Bivens field of Beauregard Parish. This well is located 1,000 ft. west and a little north of the discovery, and in Section 11-5s-12w. Total depth is 7,361 ft., with 5½-in. casing cemented at 7,353 ft. An initial gage was 151 bbl. of oil daily through ½-in. choke. Production is through perforations at 7,236-44 ft. Two failures were drilled east and north of the discovery. A new location, 3 Newport Industries, Inc., has been made approximately 1,850 ft. southwest of the new oil well.

A potential new oil discovery in East Florence area of Vermilion Parish, 6 miles east of Florence townsite. Stanolind Oil & Gas Co. 1 E. M. Watkins, 23-13s-1w, is trying for a new test. Several attempts have been made to get a dry test of squeezed perforations shot at 9,278-82 ft., but none have been successful. On test last week this well flowed at the rate of 206 bbl. of oil per day for 13 hours, then went to 90 per cent salt water.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Calcasieu Parish: New oil pay English Bayou field—Union Sulphur Co., Inc. 1 Ryan Lyons et al, 11-9s-8w, TD 5,702 ft., top sand 5,590 ft., perf. 5,590-94 ft., IP: 81 bbl. oil per day through an 8/64-in. choke, gas-oil ratio 12,000, TP 1,500 psi., gravity 33.2°, no water.

MISSISSIPPI

Jones County Gets New Oil Pool

JACKSON.—A new oil pool for Mississippi, at Sandersville in Jones County, has been opened by Union Sulphur Co. 1 Earline Parker. Drilled to a total depth of 7,280 ft., this well has been testing on pump, through perforations at 5,450-55 ft. On initial production test this well pumped 10 bbl. of oil per day plus 10 per cent basic sediment and salt water. Gravity of the oil is 10°. Top of Wilcox sand was picked at 1,671 ft., Midway 4,097 ft., Eutaw 5,366 ft., City Bank sand 5,438 ft., broken, lower City Bank sands 5,484-5,507 ft., Stanley sand 5,543 ft., Christmas sand 5,707 ft., Tuscaloosa 5,901 ft., Marginulina Tuscaloosa 6,646 ft., base of Marine Tuscaloosa 6,802 ft.

Also in Jones County, Sandersville area, Union Sulphur Co. 1 A. E. Falls Estate, wildcat, is at a total depth of approximately 7,300 ft., with pipe set at 5,456 ft. Operators are preparing to set pumping unit for testing. On drill-stem tests at 5,408-18 ft., and 5,412-34 ft., oil-cut mud with the oil testing 16° gravity had been recovered.

J. C. Hawkins 1 Lehmann, 27-7n-2e, in Franklin County, cored firm, fine-grained sand with oil stain and odor from 10,559-10,564 ft. Total depth is 10,747 ft. in Comanche. Schlumberger log was run and top of the Massive sand porosity was indicated at 10,542 ft. with a virtually solid porous sand section to total depth. Operators are attempting to secure a string of casing for production test.

In Yazoo County, J. R. Frankel 1 A. Eisner Estate, 24-11n-4w, has been completed dry after recovering salt water on drill-stem test at 6,730-750 ft., testing sand which had heavy, black, asphaltic oil saturation in samples and sidewall cores.

MISSISSIPPI SUCCESSFUL WILDCAT

Jones County: New oil pool—Union Sulphur Co. 1 Earline Parker, 31-10n-10w, TD 7,280 ft., perf. 5,450-55 ft., IP: pumped 10 bbl. oil per day plus 10 per cent basic sediment and salt water, gravity 10°, Wilcox 1,671 ft., Midway 4,097 ft., Eutaw 5,366 ft., City Bank sand 5,438 ft., broken lower City Bank sands 5,484-5,507 ft., Stanley sand 5,543 ft., Christmas sand 5,707 ft., Tuscaloosa 5,901 ft., Marginulina Tuscaloosa 6,646 ft., Base Marine Tuscaloosa 6,802 ft.

MISSISSIPPI WILDCAT FAILURE

Yazoo County: J. R. Frankel 1 A. Eisner Estate, NW NW 24-11n-4w, dry, TD 6,750 ft., Wilcox 2,059 ft., Midway 4,216 ft., Selma 5,006 ft., Eutaw 5,118 ft., Tuscaloosa 6,202 ft., Comanche 6,832 ft.

ALABAMA WILDCAT FAILURES

Bullock County: R. G. Hauser et al 2 J. L. Harris, SE SE 18-12n-22e, dry, TD 1,415 ft.

Clarke County: Amerada Petroleum Corp. 1 Thomas, NW NE 30-7n-2e, dry, TD 4,706 ft. Tuscaloosa 3,633 ft., Marine Tuscaloosa 4,390 ft., Lower Tuscaloosa 4,483 ft., Massive sand 4,678 ft.

KANSAS

Phillips Gets Good Viola Well in Pat Creek Pool

PHILLIPS PETROLEUM CO. has what looks like a good Viola producer in its 2 Darlington, CNL NW NW 29-28-9, in the Pat Creek pool, Kingman County, Kansas. The well flowed 116 bbl. of oil in one hour from total depth of 4,403 ft. after 500 gal. of acid. Viola was cut at 4,400, 1 ft. higher than the discovery well, Plains Exploration 1 Swander, SW SE SW 20-28-9, which was completed with a 1,604 bbl. bomb potential. Phillips had a dry hole with its 1 Darlington, SW NE NW 29-28-9, two locations south of discovery well.

A new Bartlesville pool in Butler County has been opened by Dunn and Strait 1 Semisch, SW SE SW 4-29-6e, 3 miles east of Fox-Bush pool. This test was completed with a potential of 50 bbl. of oil and 10 bbl. of water from total depth of 2,826, after shooting with 60 qt. of nitroglycerin.

Several extension tests have been attracting interests in Ellis County. W. C. McBride and Coppinger & Southern 1 Kraus, SE SE SE 16-14-19, had a show of oil in Reagan sand and 5-in. casing was set. Reagan was reached at 3,745 ft. and total depth was 3,751 ft.

Trojan Oil Co. 1 Copeland, NW SE SE 27-14-19, southwest of the Antonino pool which was re-activated last March, had 3,700 ft. of oil in the hole from a total depth of 3,755 ft. in Reagan sand.

A production test is planned for H. H. Blair and Earl Wakefield 1 Dean, NE NE NW 22-11-18, ½ mile west of Southwest Burnett pool, which filled with 2,300 ft. of oil in 1 hour from 3,466 ft. in Arbuckle.

Phil-Han Oil Co. and F. G. Stodder 2 Gumble, SW SW SW 5-11-17, ½ mile northeast of Burnett pool, had a show of oil from Arbuckle which was cut at 3,440 ft. The same operators in the July completed 1 Gumble, SW SW NW 8-11-17, with a 143 bbl. potential.

KANSAS SUCCESSFUL WILDCAT

Butler County: Dunn & Strait 1 Semisch,

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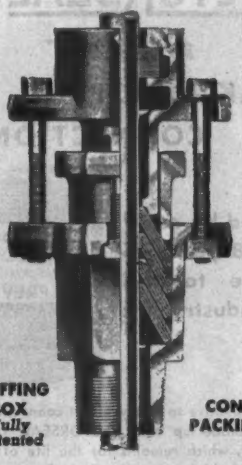

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SW SE SW 4-29s-6e, pumped 50 bbl. of oil per day from Bartlesville at 2,796-2,826 ft.; Lansing 1,775 ft., Kansas City 2,113 ft., TD 2,826 ft.

KANSAS WILDCAT FAILURES

Marshall County: Dalton Woods 2 Marshall, NW NW NW 29-4s-9e, dry, TD 1,365 ft., Viola 1,235 ft., Simpson 1,295 ft., Granite 1,347 ft.

Pratt County: Lion Oil Co. 1 Curry, NW NW NW 25-29s-12w, dry, TD 4,775 ft., anhydrite 726 ft., Heebner 3,702 ft., Basal Oread 3,744 ft., brown lime 3,880 ft., Lansing-Kansas City 3,890 ft., Basal Kansas City 4,251 ft., conglomerate 4,335 ft., Mississippian 4,343 ft., Kinderhook 4,399 ft., Viola 4,512 ft., Simpson 4,606 ft., Arbuckle 4,710 ft.

Rooks County: H. H. & B. Drilling 1 Ordway, NE NW NW 21-10s-18w, dry, TD 3,725 ft., anhydrite 1,410 ft., Heebner 3,292 ft., Lansing-Kansas City 3,338 ft., conglomerate 3,590 ft., Simpson 3,668 ft., Arbuckle 3,697 ft.

ROCKY MOUNTAIN

Mush Creek Strikes May Indicate Boom

DENVER.—The Mush Creek field near the eastern rim of the Powder River basin in Weston County, Wyoming, which has been undergoing sporadic development with varying results since the discovery well was completed in 1944, has suddenly become one of the hot spots of the Rocky Mountain area. The discovery, Western Oil Trust 1 Millhouse, SW NE SW 24-44n-63w, flowed 80 bbl. per day from the Newcastle sand at 3,851-52 ft. in February 1944, and an offset had only a show of oil, while another test ½ mile to the southeast was dry and abandoned. During the past 6 months several small wells were completed in Sections 10 and 15 with dry holes around them indicating a spotty development on account of the lenticular nature of the sand. However, as the development trended westward from these wells, better sand conditions were encountered as the formation dipped toward the basin. With increased depth the gravity of the oil improved and the sand showed more consistency. Two weeks ago Morton Drilling Co. 1 Sedgwick, C NE NE 17-44n-63w, 1½ miles west of the nearest producer, was completed for 150 bbl. of 42°-gravity oil per day flowing. Same operator moved ¼ mile to the west and drilled 1 Johnson in NE NW NW 17-44-63, completing it at 4,179 ft., total depth. Although pinched in, it flowed 1,740 bbl. of oil in 24 hours. The first hour it made 85 bbl. through a 3-in. gate on the 6⅝-in. casing, and 500 bbl. first 6 hours. Afterwards it was further pinched in, and at the end of the period showed no material change. Phillips Petroleum Co. moved in for a well in C NW SE 7-44n-63w, joint with Morton Drilling Co. and A. C. Torgeson, 1¼ miles to the northwest. This well is shut down at 4,259½ ft. pending a decision by the joint owners as to whether the sand will be cored or casing run to the top as determined by samples. No additional information has been released by the operator, but unofficial sources report the top of the sand at 4,254 ft. and showing for a good well. Phillips has moved in for an offset to the two wells in Section 17 in 1 Weston, SW SE SE 5-44-63.

East Antelope test.—Continental Oil Co.-General Petroleum Corp. 1 Unit, NW SW SE 26-27n-93w, East Antelope area, Fremont County, Wyoming, the fourth well drilled in the area recently, stopped drilling at 6,611 ft. in the top of the Mesa Verde formation, and will begin plugging back and testing. It will test the horizon at 6,360-6,530 ft., and then test gas show in Tertiary sand lense at 1,360-66 ft., where a blowout occurred. The initial flow was estimated at 15,000,000 to 20,000,000 cu. ft., but quickly was exhausted and appeared to be only a gas pocket.

West Vernal show.—Carter Oil Co. 1 Knudson, C SW NE 18-5s-21e, West Vernal, Uintah County, Utah, is drilling ahead at 5,470 ft. after encountering another small show of green oil. A drill-stem test at 4,774-4,808 ft., open 1½ hours, recovered 120 ft. of oil and gas-cut mud. Another at 4,849-72 ft. recovered 75 ft. of oil-cut mud. Location is 5 miles southeast of 1 Edna Davis, which was abandoned at 8,001 ft.

Utah's deepest well.—Pacific Western Oil Corp. 1 Unit, C SE NE 24-14s-7e, Gordon Creek district, Carbon County, Utah, deepest well drilled in the state, is drilling at 11,947 ft. in the Coconino, which was topped at 11,568 ft., and was the original objective. Formations proved to be thicker than anticipated. The Navajo was topped at 9,035 ft., Chinle at 9,840 ft., and Moenkopi at 10,140 ft.

Rangely outpost.—California Co. 2 Mellon, C SE SE 9-2n-103w, outpost on northwest flank of the Rangely field, and only well drilled in the section, pumped 108 bbl. in 16 hours from the Weber at a total depth of 6,819 ft. Top of the sand was at 6,762 ft.

Oil well in Midway area.—Big West Oil Co. 2 Proefrock, SW NW NW 7-34n-4w, Toole County, Montana, midway between the Cut Bank gas field and the Kevin-Sunburst field, was completed as a flowing oil well at 2,248 ft., total depth, making 118 bbl. through the casing the first 24 hours, and 90 bbl. next day through ¼-in. choke. It had the top of the Cut Bank sand at 2,243 ft., and 7-in. was set at 2,284 ft. It is an offset to 1 Proefrock, which was completed last year for only 15 bbl. per day. It is in the midst of several gas wells completed during the past year. Last week Union Oil Co. 1 Luther College Unit V, NE 18-34-4w, was completed in the Cut Bank sand for 3,025,000 cu. ft., extending the proven gas area ½ mile to the south.

New operations.—Thirty new operations were reported, of which 8 were in Colorado, 6 in Wyoming, and 14 in Montana. These included 7 wildcats, of which 2 were in Colorado, 2 in Wyoming, and 3 in Montana.

COLORADO SUCCESSFUL WILDCAT

Ridgeway, Ouray County: American Petroleum Co. 1 Swanson-Peterson, NE NE NE 15-45n-8w, TD 500 ft., gas in Mancos shale at 420 ft., etc., 130,000 cu. ft. per day.

COLORADO WILDCAT FAILURE

North Craig, Moffat County: Carter Oil Co. 1 North Craig, C SE SE 30-8n-90w, dry, TD 9,000 ft., Fort Union, 2,020 ft., Lance 2,965 ft., Lewis 3,126 ft., Mesa Verde 5,286 ft., Mancos 8,230 ft.

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WYOMING WILDCAT FAILURES

Hudson, Fremont County: Stanolind Oil & Gas Co. 3-M Terry, NW SW SW 10-2s-2e, TD 1,886 ft. A test to the Madison, encountered heavy flow of water in base of Tensleep, plugged back and completed in upper Tensleep through perforations at 1,695-1,767 ft. for 128 bbl. of oil and 32 bbl. of water in 24 hours as a development well. Top of Tensleep 1,697 ft.

South Elk Basin, Park County: Kirk Oil Co. 1 Skelton, NW NE NE 1-56n-100w, dry, TD 6,225 ft. Tops not released, second Frontier reported at 6,168 ft., running 2,000 ft. lower than South Elk Basin pool wells.

MONTANA SUCCESSFUL WILDCAT

Pondera, Toole County: Matt Newell 1 Hirschberg, NW SE NE 22-27n-4w, TD 1,980 ft., Ellis-Madison 1,970 ft., est. 50 bbl. per day after acid. Extension.

MONTANA WILDCAT FAILURES

Cut Bank, Glacier County: Olive Oil Co. 5 Winkler, NE NE NE 35-35n-6w, TD 2,933 ft., old well deepened from Cut Bank sand to test Madison. Top Madison 2,925 ft., show of oil with sulfur water, plugged back and recompleted in Cut Bank.

Willow Creek, Jefferson County: Hingham-Hobson Oil Co. 1 Flink, SE SE 25-33n-10e, TD 4,315 ft., water at 3,660-62 ft., old well spudded in 1942 and reworked after standing.

NORTHWEST NEW MEXICO WILDCAT FAILURE

Jacarillo, Rio Arriba County: Florence Drilling Co. 1 Tribal, NE NE SW 23-32n-3w, TD 3,710 ft., dry, tight hole.

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LA.-ARK.

Madison Parish Test Swabs Salt Water

SHREVEPORT.—Murphy and Sun Oil Co. 1 R. F. Marston, 19-16n-10e, 7 miles south of Delhi field, Madison Parish, ran a 16-hour drill-stem test at 4,940 ft. There was 15 lb. top pressure in 53 minutes, but it dropped to 0 lb. Operator swabbed 100 ft. of mud and 10 gal. of 38.2-gravity oil. After 10 hours, salt water was swabbed. When tool was pulled, recovery was 4,700 ft. of salt water with a slight show of oil and gas bubbles. Placid Oil Co. 126 Louisiana Central Lumber Co., 15-10n-4e, LaSalle Parish, was drilling below 7,522 ft. Core was taken from 7,416-66 ft., recovering 4 ft. and 2 in. coarse sand, slight porosity, no show and 2 ft. of sandy shale. C. H. Murphy, Jr. et al 1 Tensa Delta Lumber Co., 36-6n-4e, 3½ miles south of Cypress Bayou field, LaSalle Parish, was drilling below 8,517 ft. in Tuscaloosa topped at 8,315 ft.

The California Co. 2 Breece Lumber Co., 30-17n-5e, 6 miles west of the abandoned Richland field in Ouachita Parish, was drilling below 5,053 ft. after core from 4,797-4,810 ft. recovered 12 ft. of shale and hard lime with no show. Carter Oil Co. 1 Gandy, 29-19n-7w, wildcat 4½ miles northwest of Gibsland, Claiborne Parish, showed Rodessa porosity from 5,683-5,717 ft. and 5,730-40 ft. It was drilling below 6,050 ft. in Lower Glen Rose.

In Arkansas John A. Kennedy 1 Ward, 31-9s-23w, shallow test 5 miles northeast of Blevins in Hempstead County, is dry at 1,147 ft. in the Eagle Mills section. Ormond Corp. et al 1 J. D. McClurkin Estate, 33-15s-19w, a southwest extension of the Wesson field in Ouachita County, cored the Glen Rose from 3,094-3,100 ft. and recovered 16 ft. porous oil sand with good saturation. Core from 3,110-20 ft. had 7 in. saturated oil sand. Operator was coring ahead from 3,120 ft.

NORTH LOUISIANA WILDCAT FAILURES

Bienville Parish: Texas 1 W. A. Givens, 25-16n-9w, dry, TD 6,990 ft., elev. 200 ft.

Red River Parish: California Co. 1 B. S. Stephens, 1-11n-9w, dry, TD 3,502 ft., elev. 151 ft.

Union Parish: Harry N. Morris et al 1 L. Patterson, 28-22n-1e, dry, TD 2,261 ft., elev. 151 ft.

CANADIAN FIELDS

Rapid Developments Continue in Leduc Field

CHATHAM.—In the Leduc field, Imperial 8, LSD 7, 26-50-26w4, is on steady production. A drill-stem test at 5,310-20 ft. gave 110 bbl. per hour and when finally brought in it made 140 bbl. per hour flush. A later open flow test showed 252 bbl. in 2 hours, after which it was placed on 5/31-in. choke, making 167 to 176 bbl. per day.

Imperial 12, LSD 12, 22-50-26w4, is also finishing as a producer. Test at 4,957-88 ft. gave a fair flow of gas, and a further test at 4,993-5,040 ft. gave a maximum 400,000 cu. ft. of gas, with oil flowing to the surface 44 minutes after tester was opened. Hole was deepened to 5,050 ft., and shut down for repairs to the pump. Potential production is comparable to other Leduc wells.

Imperial 13, LSD 4, 23-50-26w4, is also indicated a producer; drill-stem test at 5,339-49 ft. showing maximum gas of 685,000 cu. ft. after 26 minutes. The well then started to flow oil, but was shut in for lack of storage. It offsets Imperial 4 and 6 producers. Imperial 14, LSD 9, 26-50-26w4,

is below 4,965 ft. and nearing the producing horizon, and Imperial 15 is drilling. Imperial 16 has been staked a half mile due south of Imperial 1 discovery, which got production from the D-2 zone, and ¾ mile due north of Imperial 7, producing from the D-3 zone. Two more tests are being spotted.

Globe-Leduc West 1, LSD 6, 19-50-26w4, logging higher on structure than No. 2 producer, is making drill-stem test after coring to 5,000 ft. Globe-Leduc West 3, LSD 10, 34-50-26w4, has spudded.

Leduc Consolidated 1, LSD 10, 23-50-26w4, has halted drilling in green shale at 5,402 ft. after failing to get the third zone of the Devonian. It may be finished as a gasser, having got a flow of an estimated 10,000,000 cu. ft. a day, in the upper horizons. Consolidated 2, LSD 7, 23-50-26w4, ¼ mile north, is below 2,284 ft. and drilling for the third zone. Consolidated 3, LSD 15, 23-50-26w4, is deepening from 5,085 ft. Homestead-Yaremko 1, LSD 7, 19-50-26w4, 2 miles east of Consolidated, is testing tight lime with some saturation at 4,818-80 ft.

Dunmore.—An important development in the Dunmore area, near Medicine Hat, is Dunmore-Province 33-2, LSD 7, 2-11-5w4, drilled by California Standard, which got a gas flow in the Ellis sand at 3,300 ft., estimated 6,000,000 cu. ft.

Perryvale.—Near Perryvale, in the Athabaska district of Northern Alberta, Decalta Petroleums 1, LSD 2, 27-43-23w4, drilled out plug after setting casing in Devonian limestone at 2,564 ft. Considerable gas was encountered below the casing.

De Winton.—In the De Winton area, east of the Turner Valley north extension, Royalite Oil 2, LSD 13, 24-21-1w5, got the Madison limestone, the Turner Valley producing horizon, at 7,754 ft., considerably higher than some of the more recent Turner Valley producers. The Madison was fully cored and tested, but proved unproductive, and salt water was encountered. The well is deepening below 9,044 ft., with the Devonian limestone expected around 9,100 ft.

APPALACHIAN FIELD

Operations Continue Steady Throughout Eastern Area

PITTSBURGH.—On Briery anticline in Portland district, Preston County, West Virginia, Wm. E. Snee, Orville Eberly et al logged the Brown shale at 3,800 ft. in the test on Virginia Cuppett farm and are drilling at 4,040 ft. Based on the Brown shale, this test is running higher than any of the completed wells in the new gas pool but it is an indefinite marker.

In Union district, Putnam County, Godfrey L. Cabot, Inc., topped the Corniferous Lime at 4,685 ft. from a surface elevation of 674 ft. in 1,247 Putnam Co. In this operator's 1,249 J. L. McLean Heirs, casing is being set at 4,945 ft., presumably the same formation and here the surface elevation is 954 ft.

In Poca district, Kanawha County, Emery Kirby et al completed 2 Laura F. Flowers good for 65 bbl. and 50,000 cu. ft. of gas per day from the Big lime, total depth 1,980 ft.

In Grant district, Wayne County, United Fuel Gas Co. completed 5,736 Huntington Development & Gas Co. with a final gage of 1,690,000 cu. ft. of gas from the Big lime, total depth 1,773 ft.

In Baileysville district, Wyoming County, United Producing Co. completed another Berea gas well in 1,423 W. M. Ritter Lumber Co. with the Ravencliff sand at 1,230 ft., Maxton 2,048 ft., Big lime 2,361-97 ft., Injun 2,797-2,869 ft., Berea 3,442-74 ft., gas 3,454-69 ft., shot 3,444-74 ft., total depth 3,476 ft. In Oceana district, this company's 1,453 Pardee Land Co. was good for 989,000 cu. ft. of gas from the lower Maxton or stray sand, total depth 2,044 ft.

Southern Pennsylvania.—On Chestnut Ridge in George Township, Fayette County, New Penn Development Corp. et al shut down at 7,033 ft. in 2 Mary I. Smith to run 5½-in. casing. This depth is believed close to the Onondaga lime if not in the top part of it but as there was danger of caving, and as it is an offset to the largest well on the Summit, casing was run for safety.

Maryland.—The wildcat of Columbian Carbon Co. in Garrett County drilled through black shale at 4,009 ft. in the test on Willis J. Durr farm, and at 4,136 ft. reached a lime not yet classified.

New locations totaled 21 in West Virginia and 3 in southwest Pennsylvania.

WEST VIRGINIA SUCCESSFUL WILDCATS

Jackson County, Ripley district: United Fuel Gas Co. 6,189 T. B. Kittle, 189,000 cu. ft. gas, elev. 722 ft., Corniferous lime 4,831 ft., Oriskany 4,925-56 ft., gas 4,928-30 ft., shot 4,925-87 ft., TD 4,987 ft.

Lincoln County, Harts Creek district: R. H. Adkins 1 Lester Brumfield, 1,004,000 cu. ft. gas, Brown shale, TD 2,800 ft.

Mingo County, Kermit district: E. C. Ware 1 Zennis Johnson, 984,000 cu. ft. gas, Salt sand, TD 1,090 ft.

Wyoming County, Oceana district: Godfrey L. Cabot, Inc. 1227 C. W. Murphy, 1,264,-000 cu. ft. gas, Ravencliff sand 1,432 ft., gas 1,461-71 ft., Maxton sand 2,086 ft., Big lime 2,359-2,669 ft., gas 2,493 ft., In-

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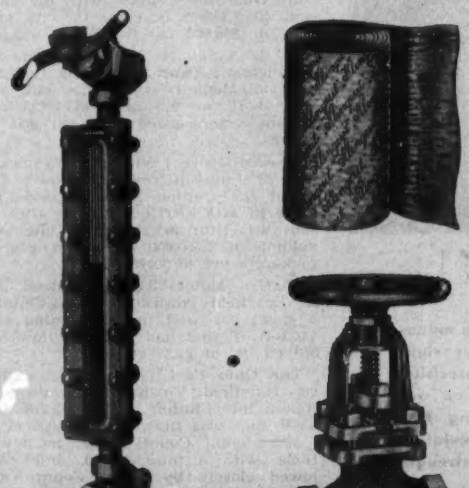

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jun sand 2,687-2,745 ft., acidized, rock pressure 760 psi. 4 days, TD 3,246 ft.

WEST VIRGINIA WILDCAT FAILURE

Nicholas County, Summerville district: Pittsburgh & West Virginia Gas Co. 8,132 Peter Harold, dry, big lime; TD 2,552 ft.

EASTERN TEXAS

Hopkins County Test Opens New Area

DALLAS.—Delta Drilling Co. 1 W. H. Coker, Nacogdoches University lands, discovery 3½ miles southeast of Reilly Springs in Hopkins County, pumped 93 bbl. of oil in 23 hours from the sub-Clarksville sand through perforations from 4,152-58 ft. Gravity of oil is estimated to be around 23°. Total depth of the well is 4,210 ft. Stanolind Oil & Gas Co. 1 George Slaughter, J. E. White Survey, 8 miles northeast of Marshall, Harrison County, on a drill-stem test of the Travis Peak from 6,840-60 ft. recovered 100 ft. of drilling mud with no shows. Operator is preparing to plug back and test the Pettit. Total depth is 10,374 ft.

Although it was high structurally to the discovery well in the Mount Sylvan pool of northwestern Smith County, the Paluxy sand so far has been dry in the B. G. Byars 1 Jones, E. C. Bryant Survey. The wildcat is southwest of the pool but in Van Zandt County. The wildcat topped the Paluxy at 7,030 ft. and was reported to be 264 ft. high to the discovery. Elevation is 456 ft. The upper Paluxy sand was missing and salt water was found from 7,160-64 ft. It was drilling below 7,275 ft. Amerada Petroleum Corp. will drill 1 Lawrence Parker, J. Sparks Survey, 5 miles northeast of Edgewood, Van Zandt County. The 4,000-ft. test is approximately 530 ft. southwest of H. L. Hunt 1 Republic Insurance Co., same survey, which was a failure at 6,430 ft.

Delta Drilling Co. 1 H. Y. Jackson, Hesekiah George Survey, wildcat 3 miles south and slightly east of Swan, Smith County, is dry at 7,806 ft. Paluxy was topped at 7,572 ft. D. H. Byrd et al 1 T. W. Blount, E. Quirk Survey, is a new 10,000-ft. wildcat being drilled 4 miles southwest of San Augustine, San Augustine County. The test is about the same distance south of Hiawatha 1 Johnson, Pettit discovery.

EAST TEXAS SUCCESSFUL WILDCATS

Anderson County: R. B. Sanders and John W. Murchison 1 L. W. Sides, Isreal P. Rinehart Sur., 2 mi. E Blackfoot, flowed 406 bbl. 44.1°-gravity oil a day, top Pettit 9,644 ft., TD 10,182 ft., elev 328 ft.

Smith County: Chapel Hill Gas System 1 Bina Rayford, Thos. Payne Sur., 15 mi. SE Tyler, new pay Chapel Hill field, flowed 101 bbl. oil a day 51° gravity, top Travis Peak 8,070-80 ft., TD 8,340 ft., elev. 473 ft.

EAST TEXAS WILDCAT FAILURE

Anderson County: Standard Oil Co. 1 Southern Pine Lumber Co., Jesse Gibson Sur., 16 mi. SE Palestine, dry, TD 6,046 ft., Pecan 4,233 ft., Austin 5,175 ft., Woodbine 5,477 ft., elev. 371 ft.

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OHIO, KENTUCKY

Gas Completions In Limelight

COLUMBUS.—The Ohio Fuel 1 H. E. Eckelberry, Section 4, Knox Township, Guernsey County, with the Oriskany sand at 3,312-32 ft. came in with an open flow of 868,000 cu. ft. of gas natural.

W. L. Linkhorn 5 C. Z. Ruth, Section 33, Pleasant Township, Perry County, got a good Medina well while still drilling only 3 ft. in the sand at 3,835 ft. The volume when gaged was 4,917,000 cu. ft. of gas.

Beasley-Grove 1 Veronica Wycinski, Section 33, Pleasant Township, Perry County, found the Clinton sand at 3,685-3,710 ft., came in at 680,000 cu. ft. and after it was shot was shut in 2½ hours later with a volume of 1,550,000 cu. ft. of gas and a rock pressure of 1,175 psi.

Modern Motors 3 Martha Reed, Section 22, Bearfield Township, Perry County, got a small gas well in the Medina sand at 4,033-41 ft. that had an open flow of 600,000 cu. ft. of gas.

The Ohio Fuel 1 C. L. Pickworth, Lot 98, Pittsfield Township, Lorain County, found the Clinton at 2,208-2,218 ft. and after shot was shut in at 145,000 cu. ft.

Muskingum County leads in new locations, with a total of 10, and was followed closely by Perry County with 7. Altogether 12 counties divided up 35 new locations, with Meigs, Licking and Stark counties having 3 each.

WESTERN KENTUCKY

OWENSBORO.—I. B. Browning has completed his 1 Ray Hobgood, 2-L-24, flowing 50 bbl. oil per hour for the biggest well yet in the new Slaughters pool in Webster County. Production is from tight Tar Springs sand at 2,493-2,523 ft. Electric log shows 57 ft. of oil sand.

George S. Engle has brought in another good Slaughters pool producer, his 1 Tom

Sizemore, 3-L-24, which flowed 30 bbl. oil per hour from Tar Springs at 2,530-62 ft.

WESTERN KENTUCKY WILDCAT FAILURE

Hopkins County: Borden et al 2 Johnson, 1-K-25, dry, TD 2,904 ft., Tar Springs 2,375 ft., Ste. Genevieve 2,856 ft., elev. 3,175 ft.

INDIANA

EVANSVILLE.—The new Evansville pool, 1½ miles north of the Evansville city limits, showed for one producer and one dry hole this week. Superior Oil Co. 2 A. Barchet, SW SW SW 2-6s-11w, was completed in the Pennsylvanian at 917-27 ft. for initial pumping production of 36 bbl. Clarence Wood had a dry hole with his 1 Ben Bockelman Unit, SW SW NW 2-6s-11w, which had a total depth of 1,055 ft. and hit the top of Tradewater lime at 872-76 ft. Five wells are now drilling in the Evansville pool, one location has been staked, and tools are being moved in for another well.

Glenwood Oil Co. has brought in a good producer in the Union-Bowman field of Gibson County. Its 3 Shoulders, NE SW NE 13-1s-10w, had an initial production of 125 bbl. from total depth of 1,726 ft.

Magnolia Petroleum Co. 9 F. B Armbruster, SE SE SE 14-7s-14w, Posey County, has been completed in the Clore and Weinberg for 40 bbl. per day on pump.

ILLINOIS

Wabash County Wildcat Looks Good in McClosky

MATTOON.—Arch F. Dye 1 Paul Clodfelter, NW¼ 36-2n-14w, 5 miles northeast of West Salem, found good oil saturation in McClosky at 2,912-21 ft. Six-minute drill-stem test got gas in 5 minutes and recovered 240 ft. of oil, 90 ft. of oil-cut mud, and no water. This wildcat is in Wabash County in Berryville pool area.

A Tar Springs sand well has been hit in the Inman pool, Gallatin County, by R. B. Martin, Illinois Oil Co., and Puritan Drilling Co. with their 1 Straub, NE NE NE 21-8s-9e. Other wells in this field produce from Cypress sand at 2,485 ft. The 1 Straub swabbed 5½ bbl. an hour from Tar Springs at 2,191-2,215 ft. after being shot with 40 qt.

Phillips Petroleum Co. completed 1 Ginther, SE SE NE 35-2n-14w, for a flowing potential of 1,343 bbl. to set off activity in the area 5 miles northeast of West Salem, Wabash County. Production is from McClosky at 2,902-05 ft.

A north outpost to Rural Hill pool, Hamilton County, has been completed by Calstar Petroleum Co. with its 1 Marion F. Hughes, SW SW NW 5-6s-6e. The well swabbed 507 bbl. oil from Aux Vases sand at 3,104-27 ft.

ILLINOIS SUCCESSFUL WILDCATS

Richland County: George & Wrather 1 Leaf, SW NE NW 13-4n-10e, IP 25 bbl. of oil per day, TD 3,082 ft.

Wayne County: Collin Bros. 1 Flowers, S/2 SW NW 27-1s-9e, IP 14 bbl. of oil per day, TD 3,403 ft.

ILLINOIS WILDCAT FAILURES

Clark County: Lewis Marland 1 Englehardt, NW SE NE 18-10n-13w, dry, TD 609 ft.

Crawford County: Black 1 Beeson, NE SE NW 7-6n-10e, dry, TD 940 ft.

Jackson County: Bryan Kimmel 1 Klindera, SW SW SW 14-7s-1w, dry, TD 2,306 ft.

Jefferson County: Indiana Farm Bureau 1 Weisbecker, NW NW SE 11-2s-1e, dry, TD 2,448 ft.

George & Wrather et al 1 Lankford, SE SW SE 21-4s-4e, dry, TD 3,302 ft.

Madison County: Birkheimer 1 Dewerff, E/2 NE SE 31-6n-8w, dry, TD 320 ft.

Marion County: Buell & Doran 1 Hayes, SW SE SW 11-3n-2e, dry, TD 2,347 ft.

Trans-Arabian Station Construction

(Continued from page 60)

these water systems will serve for the cooling of engine-jacket water from 170° F. down to 155° F. The other will cool lubricating oil 145° F. to 135° F. These radiator cooling systems will be operated with electric-motor-driven fans.

All water used at the stations will be procured from wells. Before using for either domestic or cooling purposes the water will be evaporated and condensed.

At each station a 90,000-bbl. tank will be installed which will float on the line. Later it is expected that additional tankage may be furnished.

Large-diameter valves for the 30 and 31-in. pipe are being furnished by Ludlow.

Facilities planned provide for potential capacity from 320,000 to 370,000 bbl. daily. Each of the big pumps will have 14-in. discharge and 16-in. suction, double volute case and double suction. The pump will be of single-stage type operating at 2,250 r.p.m. with 205 lb. discharge pressure. Any four units will operate in series at a total discharge pressure at 820 psi. with a volume throughput of 400,000 bbl. per 24 hours. Each pump is rated for a power requirement of 1,565 hp.

Each station will be equipped with two booster pumps operating in parallel and pumping into the suction of the first of the large pumps operating in series. Each of these booster pumps will be driven by 200-hp. electric motor directly connected and operating at 900 r.p.m. Each of these pumps will have a capacity of 180,000 bbl. delivery; together they will have a total of 360,000 bbl. The booster pumps will develop 40-lb. suction pressure at the suction of the first big pump.

The initial station at Ras Tanura will have two Byron Jackson pumps,

SUMMARY OF AUGUST COMPLETIONS

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
New York	202	101	217	0	[1]101	0	202	0	0	0	289,000	171
Pennsylvania	339	168	351	26	[2]145	0	0	339	0	0	538,561	256
West Virginia	76	9	118	61	[3]6	1	34	36	5	0	219,987	265
Ohio	124	28	1,155	52	[4]44	11	37	76	0	0	344,504	249
Indiana	51	17	1,244	5	29	14	28	9	0	0	84,172	69
Kentucky	77	26	783	17	34	14	42	21	0	0	121,919	76
Illinois	208	97	5,873	0	111	15	45	148	0	0	532,064	231
Michigan	99	40	29,361	5	[5]54	1	73	24	1	0	210,535	123
Kansas	237	121	49,717	25	[6]91	1	24	206	6	0	773,910	383
Neb., Mo., Iowa	1	0	0	0	1	0	1	0	0	0	3,604	12
Oklahoma	364	[7]181	20,421	41	[8]142	18	122	176	46	2	1,063,946	563
Texas	1,043	629	132,121	46	368	90	257	390	288	18	4,299,382	1,060
North	277	145	15,983	5	127	41	129	81	26	0	712,438	166
West Central	108	38	5,587	3	[9]67	12	33	58	5	0	304,906	86
West	309	266	81,196	1	42	23	59	141	81	5	1,373,779	203
Panhandle	46	30	3,050	7	9	0	5	36	5	0	158,483	130
Eastern	54	[10]20	12,519	10	24	2	3	18	30	1	343,669	102
Gulf Coast	130	[11]75	8,046	8	47	2	5	26	85	12	857,568	201
Southwest	119	[12]55	5,740	12	52	10	23	30	56	0	548,539	172
Louisiana	195	130	15,139	9	56	10	72	32	53	28	972,231	233
Northern	124	[13]81	5,777	9	34	10	72	25	16	1	336,055	93
Southern	71	[14]49	9,362	0	22	0	0	7	37	27	636,176	140
Arkansas	42	23	2,631	1	18	0	7	27	8	0	166,654	36
Mississippi	55	[15]38	11,203	4	13	0	0	5	27	23	460,673	68
Ala., Ga., Fla.	9	0	0	0	9	0	1	5	2	1	48,391	13
Montana	42	22	6,834	13	7	4	21	16	1	0	92,565	83
Wyoming	32	18	3,356	1	13	1	4	22	4	1	130,797	111
Colorado-Utah	21	16	2,851	0	5	1	1	1	18	0	114,654	84
New Mexico	56	41	9,112	3	12	3	6	29	18	0	231,513	114
California	129	105	17,831	2	22	5	24	53	40	7	561,165	247
Total August	3,402	1,810	310,318	311	1,281	189	1,000	1,616	517	80	11,260,221	4,447
Total July	3,387	1,842	349,983	336	1,209	146	1,001	1,579	586	75	11,762,389	4,357

Service wells included: [1]101, [2]135, [3]1, [4]4, [5]9, [6]2. Distillate wells included: [7]3, [8]4, [9]12, [10]6, [11]5.

each of which will be directly connected to a 6,000-hp. steam turbine operating at 3,600 r.p.m. Each pump has been designed to deliver 400,000 bbl. per day; this is equivalent to 11,000,700 g.p.m. at 775-psi. discharge, with 70-psi. absolute suction pressure. The specific gravity of the crude oil will be 0.802. One of these two units will be capable of handling entire throughput of the line. The second pump will serve as a standby. Pump cases will be tested for 1,300-psi. hydrostatic test pressure. Each pump will have 14-in. discharge and 16-in. suction, two double suction impellers and double volute case. These particular centrifugal pumps will be the largest units ever manufactured for oil pipe-line operation.

Positive Action Needed To Combat State Control

(Continued from page 55)

the wheels turning. It is a continuing job, too, for next year and the years after that. Public relations is a way of life, and you can't achieve good public relations by one brief effort . . ."

Next year an effort will be made by the A.P.I.'s public-relations organization to spread the increasing cost of the public-relations program, both as a means of defraying added expenses and in order to obtain wider participation. Tentative plans call for asking the contributions of some such sum as $1 from service-station operators, mostly as a means to give them a proprietary interest in the program.

Other highlights of the NPA meeting included an address by Sun Oil Co.'s President Robert G. Dunlop *(The Oil and Gas Journal, September 20, page 154)*; detailed discussions of labor relations; and in particular, the effect of the Taft-Hartley Act on bargaining negotiations and grievance procedure. Richard H. Lowe, counsel, Socony-Vacuum Oil Co., Inc., spoke on "New Collective-Bargaining Contracts in the Petroleum Industry," at a round-table discussion. Reviewing the Taft-Hartley Act, Lowe said:

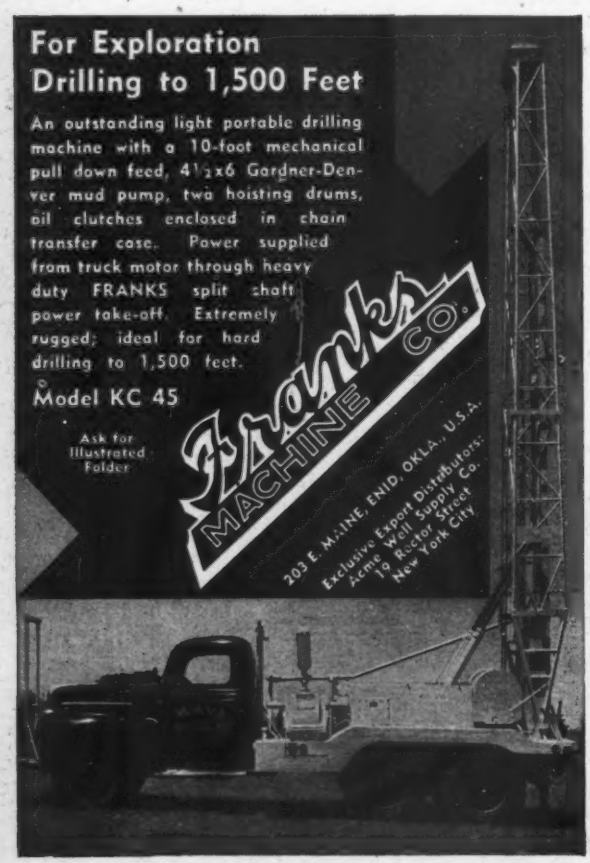
"The clause . . . which seems likely to provoke the most discussion is the no-strike clause. This clause has many variations in language, but generally speaking it usually states that during the term of the agreement there will be no strikes and no lockouts. After all, one of the purposes of a collective-bargaining agreement is to set forth working conditions in such a way that everyone covered by the agreement will be apprised of the nature of his rights, benefits, and obligations."

B. C. Graves, president of Union Tank Car Co., urged oil shippers to support the railroads in their fight to cut down operating inefficiencies caused by "featherbedding," and thereby reduce the need for higher rail freight rates. While some present said that higher freight rates would force them to shift their business to other types of carriers and would spur additional pipe-line construction, the consensus was that the oil industry is reluctant to oppose the railroads' demand for an immediate 10 per cent boost in view of the recent wage hikes and other increased costs.

James A. Perkins, vice president of Swarthmore College, echoed the conclusions reached by Haslam in an address titled "The Economic Future of Europe."

Dr. Alexander Sachs, economic adviser and former member of the Petroleum Industry War Council, saw a need for revising the oil industry's depletion allowance with the aim of providing more money for exploratory and development operations.

NPA's board of trustees reelcted the following officers: J. B. Fisher, president; W. S. Zehrung, first vice president; Earle M. Craig, second vice president; Fayette B. Dow, general counsel; Harry S. Elkins, traffic attorney; Horace L. Lohnes, Joseph E. Keller, and Donald C. O'Hara, attorneys; Herbert G. Eaton, recording secretary; and G. B. Hunter, treasurer.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Drilling Contractors

Miller & Shiarella Active In Western Kentucky Pool

Miller & Shiarella, Owensboro, Ky., have five rigs running in Guffie pool, 15 miles south of Owensboro, which is one of Western Kentucky's most important recent discoveries. The firm has previously completed all the 14 wells drilled in the field which are producing between 40 and 300 bbl. daily from Tar Springs sand at around 2,000 ft.

Keating Drilling Co., Olney, Ill., is drilling a wildcat for The Texas Co., the 1 W. Scott, NW NW SW 27-1n-5e, Wayne County, Illinois.

Henderson Drilling Co. has staked location for its 1 Cole, a wildcat in C NW SE 33-2n-20w, Jackson County, Oklahoma.

Dunlap & Graham, Long Beach, are under contract for five wells for Long Beach Oil Development Co. in Wilmington field, Los Angeles County, California. **Fowler Drilling Co.,** Long Beach, is drilling Z 1-13, Z 1-14, and Z 1-15 for Long Beach in the same field.

Wayne Drilling Co. has staked location for its 1 Miller, SE NW NE 27-2n-7e, Wayne County, Illinois.

Ferrell Drilling Co. is rigging up for an Aladdin Petroleum Co. well, the 2 Dugan, SE NW SE 7-28-1w, Sedgwick County, Kansas.

Williams & Copeland, Tulsa, are drilling Ohio Oil Co. 2 Burnett, Section 2, Block 2, Lazarus Survey, King County, North Texas.

Sterling Drilling Co., Sterling, Kans., has an oil well with its 1 Miller, SW SE NW 3-21-6, Rice County, Kansas. The well has a pump potential of 150 bbl. per day from Mississippi at 3,420 ft.

Mallard Drilling Co., Wichita, and Westgate-Greenland Oil Co. have brought in a producer in McPherson

Crew of Warren & Bradshaw Drilling Co., Tulsa, on The Texas Co. 1 Tessy Lindsey, Garvin County, Oklahoma, and Earl Thomason, Braur Mfg. Co., on the left. Warren & Bradshaw personnel are: Harold Brand; M. E. Glass; W. C. Culberson; Ralph Vararsdel; L. O. Ward, toolpusher; and J. W. Deebin, driller

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WEB WILSON *Oil Tools*

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HUNTINGTON PARK, CALIF.

County, Kansas, their 1 Frisbie, SE SE NW 1-18-1. The well has a pump potential of 495 bbl. per day from Mississippi at 2,774 ft.

Brown Drilling Co., Long Beach, is the contractor for a wildcat to be drilled by Lowry Lytle, 5 miles northwest of Raisin City field, Fresno County, California.

H. E. R. Drilling Co. is rigging up rotary for a Payne County, Oklahoma, wildcat, its 1 Carl Johnson, NW NW SW 29-18n-3e.

Commonwealth Drilling Co. is starting on a wildcat for McColl-Frontenac Oil Co. in the Leduc region of Central Alberta, Canada. This test is the second of three which McColl-Frontenac has scheduled for the area. It is their 8-24-42-24, LSD 8, 24-43-24w4, 11 miles southeast of Ponoka and 50 miles southeast of the new Leduc field.

Smith-Horton Drilling Co., Tulsa, has a 3,900-ft. test under way in Seminole County, Oklahoma. The wildcat is 1 Backman, SE NW SW 16-10n-7e.

Orval Parker, Glenrock, Wyo., has contract for two Poison Spider field wells and three South Casper Creek wells to be drilled by Morton Oil Co. in Wyoming.

Severns Drilling Co., Los Angeles, will drill British-American Oil Co. 4 Bodger, in the Alondra area, California. Severns recently completed a producer for British-American in the same area, the 1 Park Community which bottomed at 9,238 ft.

Hall-Miller Drilling, Inc., Oklahoma City, is drilling a 4,650-ft. test in Oklahoma County, Oklahoma, its 2 Geisler, NE NW SE 26-13n-1e.

Gilliam Drilling Co. has brought in a wildcat for 41 bbl. per day, its 1 W. Hines in NW NW SW 36-5s-10e, White County, Illinois.

Karels & Federspiel have recently completed three wells in the Lloydminster area of Canada. They are Ace 4, NE LSD 14-48-27w4; Republic 2, NW LSD 15, 25-48-28w3; and Republic 4, NE LSD 15, 25-48-28w3. All wells were completed in the Sparky sand at around 1,800 ft.

Crown Drilling Co. is drilling Fresno Oil Investment 2 Phelps Government, a wildcat in Oil City area, Coalinga field, California.

Sullivan Brothers Drilling Co., Gainesville, Tex., is drilling a 1,500-ft. test in Cotton County, Oklahoma, its 1 D. W. Crawford, NE NE SW 5-3s-10w.

Warren-Bradshaw Drilling Co., Tulsa, has contract for Stanolind Oil & Gas Co. 2 Reinhart, C SE SW 30-13n-2w, Witcher field, Oklahoma County, Oklahoma. This well is an east offset to 1 Reinhart, the discovery well of Witcher field. Warren-Bradshaw had the contract for the initial well also.

Fred M. Manning, Mid-Continent drilling contractor, is spudding in a well for Continental Oil Co. in San Joaquin Valley, California. Known as the KCL-L-2, this deep test is being closely watched by California oil men. This is the first time Manning has operated a string of tools in California. Shown are: A. J. Olson, chief engineer, Continental Supply Co.; W. R. Fairbanks, roughneck, Fred M. Manning; C. T. Whitney, drilling superintendent, Fred M. Manning; J. C. Craig, drilling superintendent, Continental Oil Co., Ed Sutton, driller, and Cecil Crolley, Lester Hoewing, and Bob Doolan of the Manning drilling crew

Brown Drilling Co. Long Beach, is the contractor for Lowry Lytle 1 Petrol-Kerchkoff, a wildcat 5 miles northwest of Raisin City field, Fresno County, California.

Goll, Graves & Mechling will drill Lowell Bernhardt 1 Michael J. Klodniski, SW SE NE 12-17n-3e, a wildcat in Bay County, Michigan.

Ferrell Drilling Co., has the contract for an Aladdin Petroleum Corp. wildcat 3½ miles west of Wichita, Kansas. The test is 1 Wood, SE SW NE 32-27-1w, 3 miles northeast of Schulte pool.

Commonwealth Drilling Co., Calgary, Alta, is drilling three wells for Husky Refining Co. and one for Hale Syndicate of Montana in Lloydminster field, Canada.

Falcon Seaboard Drilling Co., Tulsa, and J. J. Lynn are drilling a 5,200-ft. test in Lincoln County, Oklahoma. The test is 1 Logan, SE SE SE 10-14n-4e.

Kiowa Drilling Co., Wichita, has brought in a flowing producer at 100 bbl. per day for Solar Oil Co. in Rush County, Kansas. This wildcat is 1 Tammen, SW SW SW 24-19-16.

Cox Drilling Co. has completed a producer, its 2 Perry Malott, 400 ft. from south and 400 ft. from east lines, NE NW 34-1n-9w, Pike County, Indiana. Initial production was 50 bbl. per day from total depth of 975 ft.

Gordon Drilling Co. has contract for an Arenac County, Michigan, wildcat, the Eric P. Schelling 1 Garrett Hamstra, SW NE NE 2-2n-13w.

C. P. Burton, Dallas, has brought in a producer for Roy Hoffman, Jr., and Shirley Thomas in western Garvin County, Oklahoma. This test, the 1 McClain, SW NW NW 25-2n-1w, showed 2,000 ft. of oil on drill-stem test of Deese sand.

Jackson Drilling Co., Tulsa, is drilling an important wildcat in Ellis County, Kansas, for Westgate-Greenland Oil Co. The test is 1 Sack, NW NW NW 15-23-19, 6 miles northwest of Hayes and 8½ miles northeast of Irvin pool.

R. H. Gracey is to drill a 12,000-ft. exploration test for Union Oil Co. of California. The 1 Edmond Dugas et al is located in 32-13s-5e, Tigre Lagoon discovery area of Vermilion Parish, Louisiana.

Viersen Drilling Co., Okmulgee, Okla., is starting its 1 Pharoch, NW NE SW 11-12n-11e, Okfuskee County, Oklahoma.

Shamrock Drilling Co., Los Angeles, has two rigs working for Union Pacific Railroad in Wilmington field, Los Angeles County, California. Shamrock is also redrilling Standard 17 Rubel in Inglewood field.

Woods Drilling Co., New Orleans, has hit what looks like a good pool in eastern Logan County, Oklahoma. The company's 1 Crabtree, NW NE NW 4-16n-1e, recovered 420 ft. of clean oil on drill-stem test of first Wilcox sand and went ahead to find second Wilcox at 5,236 ft.

Drilling Contractors, Ltd., Calgary, Alta, has contract to drill the first test for Home Oil Co. in Leduc field, and are moving equipment to location in LSD 11, 21-50-26w4, ½ mile west of Imperial 15.

Ralph Lowe, Midland, Tex., is contractor for W. O. Woodward 1 B. Williamson, in northwest corner of Section 189, Block 1, H&GN Survey, 3 miles south of Spur, Dickens County, West Texas. Contract is for 8,500 ft. or Ellenburger sand.

Smiley & Little Drilling Co. has started a deep test for Roy Starr in southeastern Oklahoma County, Oklalahoma, the 1 Beland, C NW SE 13-11n-1w, near Newalla. The test is for 6,600 ft. or second Wilcox sand.

Godfrey Drilling Co. has contract for a test, the V & S Oil Co. 1 Fred Hemstreet, SE NE NE 26-1s-15w, Van Buren County, Michigan.

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STATISTICS and

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 20, 1947

	Total of all wells							Wildcat completions and discoveries									
						Cum							Cumulative total, 1947				
	Comp.	Oil	Gas	Dry	Footage	1947	1946	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	45	22	0	*23	63,126	1,178	1,144	0	0	0	0	0	3	0	0	2	5
Pennsylvania	73	38	5	†30	116,488	2,124	2,878	0	0	0	0	0	0	0	3	1	4
West Virginia	17	3	11	3	41,220	605	533	0	0	4	1	5	0	0	18	8	26
Ohio	27	7	5	‡15	60,214	942	887	0	0	0	0	0	0	0	4	32	36
Indiana	7	4	0	3	12,286	457	258	2	0	0	1	3	22	0	0	34	56
Kentucky	3	1	0	2	8,249	486	342	0	0	0	1	1	8	0	0	33	41
Illinois	62	36	1	§25	148,035	1,473	1,642	2	0	0	7	9	53	0	1	252	306
Michigan	24	9	7	8	52,177	623	589	0	0	0	5	5	7	0	10	161	178
Kansas	57	30	16	11	177,100	1,857	1,427	1	0	0	3	4	30	0	12	247	289
Neb., Mo., Iowa	0	0	0	0	0	4	15	0	0	0	0	0	0	0	0	4	4
Oklahoma	91	40	20	31	271,599	2,985	1,962	3	0	1	11	15	80	5	14	498	597
Texas	194	121	8	65	885,373	6,535	5,755	10	0	1	28	39	212	45	63	980	1,300
North Central (Dist. 7-B & 9)	55	25	1	29	180,203	2,112	2,066	1	0	1	4	6	63	0	9	329	401
West (Dist. 7-C & 8)	50	46	0	4	206,428	1,575	1,241	5	0	0	2	7	27	0	3	117	147
Panhandle (Dist. 10)	11	5	5	1	33,561	317	235	0	0	0	0	0	1	0	1	8	10
Eastern (Dist. 5 & 6)	12	10	1	1	83,594	373	527	2	0	0	1	3	7	1	4	79	91
Gulf Coast (Dist. 3)	41	21	0	20	274,175	1,142	1,260	1	0	0	14	15	52	33	26	213	324
Southwest (Dist. 1, 2 & 4)	25	14	1	10	107,412	1,016	426	1	0	0	7	8	62	11	20	234	327
Louisiana	27	13	2	12	137,444	1,052	980	1	0	0	3	4	28	17	9	146	200
Northern	19	7	2	10	62,176	599	551	0	0	0	3	3	3	1	3	89	96
Southern	8	6	0	2	75,268	453	425	1	0	0	0	1	25	16	6	57	104
Arkansas	5	5	0	0	14,428	207	131	0	0	0	0	0	1	0	0	40	41
Mississippi	10	8	0	2	89,801	346	176	1	0	0	1	2	1	0	1	65	67
Southeastern States	3	1	0	2	9,416	44	31	0	0	0	2	2	0	0	0	38	38
Montana	11	6	2	3	23,170	200	224	1	0	0	2	3	5	0	5	19	29
Wyoming	6	3	1	2	27,497	169	126	0	0	0	2	2	11	0	3	27	41
Colorado-Utah	7	5	1	1	42,507	146	108	0	0	1	1	2	2	0	2	37	41
New Mexico	15	12	1	2	73,615	381	274	0	0	0	2	2	5	0	1	28	34
California	49	39	1	9	213,584	1,398	1,190	0	0	0	9	9	36	0	6	203	245
Total United States	733	403	81	249	2,467,329	23,212	20,672	21	0	7	79	107	507	67	152	2,855	3,578
Total previous week	691	386	56	249	2,246,945	22,479	20,089	17	1	5	79	102	483	67	145	2,776	3,471
Total Sept. 21, 1946	583	300	66	217	1,806,371			16	2	3	82	103	401	31	89	2,457	2,978

Service wells included: *23, †30, ‡2, §1.

CRUDE PRICES AND REFINERY ACTIVITY

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.*	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
18-18.9	$1.60	....	....	....
19-19.9	1.65	....	....	....
20-20.9	1.69	$1.55	....	$1.42
21-21.9	1.73	1.57	....	1.44
22-22.9	1.77	1.59	....	1.46
23-23.9	1.80	1.61	....	1.48
24-24.9	1.84	1.63	$1.86	1.50
25-25.9	1.88	1.65	1.88	1.52
26-26.9	1.91	1.67	1.90	1.54
27-27.9	1.95	1.69	1.92	1.56
28-28.9	1.99	1.71	1.94	1.58
29-29.9	2.02	1.73	1.96	1.60
30-30.9	2.06	1.75	1.98	1.62
31-31.9	....	1.77	2.00	1.64
32-32.9	....	1.79	2.02	1.66
33-33.9	....	1.81	2.04	1.68
34-34.9	....	1.83	2.06	1.70
35-35.9	....	1.85	2.08	1.72
36-36.9	....	1.87	2.10	1.74
37-37.9	....	1.89	2.12	1.76
38-38.9	....	1.91	2.14	1.78
39-39.9	....	1.93	2.16	1.80
40 and above	....	1.95	2.18	1.82

*Standard Oil Co. of Calif. posting. †For crude from Daboval, El Campo, and Sandy Point. ‡Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT, WEEK ENDED SEPTEMBER 13

(Thousands of barrels)

District—	Crude runs, daily avg.	Production: Gasoline†	Kerosine	Gas & dist. oil	Residual	Stocks at refineries, bulk terminals, in transit and in pipe lines: Gasoline*	Kerosine	Gas & dist. oil	Residual
East Coast	840	2,065	280	1,191	1,562	19,002	9,068	17,731	9,838
Appalachian:									
District 1	105	341	58	71	108	2,135	398	641	354
District 2	64	221	25	40	112	872	168	230	232
Ind., Ill., Ky.	857	2,853	371	842	1,059	14,885	2,925	7,832	5,264
Okla., Kans., Mo.	445	1,595	130	497	500	6,801	1,208	3,244	1,512
Inland Texas	229	992	112	134	371	2,559	582	556	834
Texas Gulf Coast	1,305	4,068	764	1,673	1,983	13,141	3,455	9,034	7,425
La. Gulf Coast	398	1,260	303	474	641	4,960	2,298	2,969	2,013
N. La. and Ark.	68	170	50	60	110	1,628	525	336	224
Rocky Mountain:									
New Mexico	13	41	4	11	19	85	15	24	36
Other Rocky Mt.	138	459	27	154	199	1,680	169	924	718
California	856	2,440	32	906	2,193	14,761	1,021	14,098	27,718
September 13, 1947	5,318	16,505	2,156	6,053	8,855	82,509	21,832	57,619	56,168
September 6, 1947	5,246	16,205	1,917	6,337	8,708	83,336	21,102	56,763	56,168
September 14, 1946	4,886	14,892	1,957	5,601	8,209	87,313	20,613	57,340	56,238

*Finished and unfinished. †At refineries including natural blended.

Bureau of Mines crude-oil stocks 226,509,000 bbl. as of September 13—up 355,000 bbl. One year ago 221,903,000 bbl.

FLAT CRUDE PRICES

Representative posted schedules per bbl.	
East Texas	$1.95
Kettleman Hills, California*	2.14
Beauregard Parish	1.90
Illinois Basin	2.07
Pecos County, Texas (Yates)	1.65
Bradford, Pennsylvania	4.50
Eastern Ill. and Western Ind.†	2.07
Tomball, Texas Gulf Coast	2.10

*37°-37.9°. †35° and above.

TRENDS

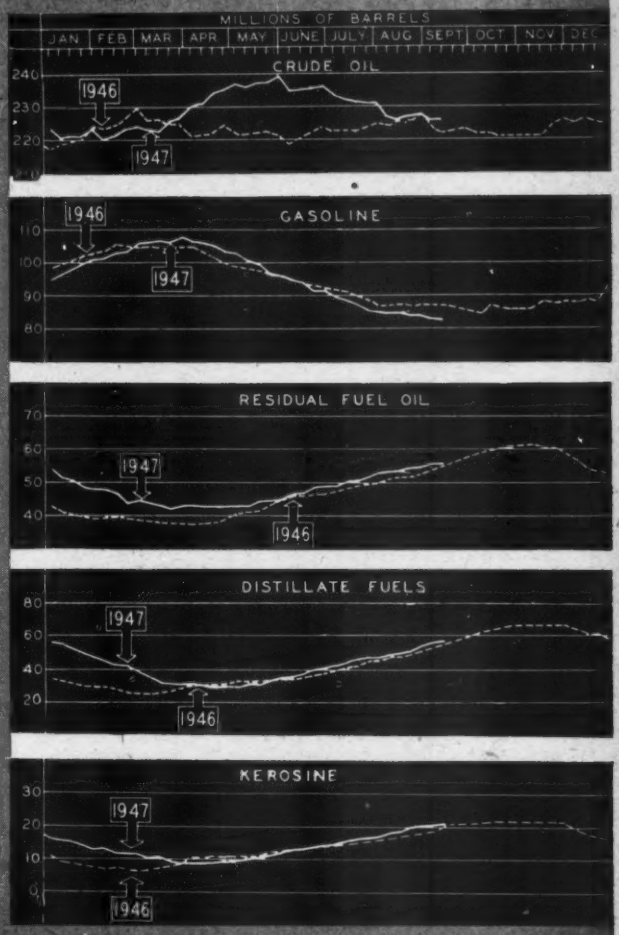
DAILY AVERAGE PRODUCTION FOR WEEK

	Sept. 20 crude oil	B. of M. Sept. demand	Sept. 13 crude oil
Alabama	1,000	1,000	1,100
Arkansas	82,350	82,000	82,350
California	921,700	930,000	924,900
Colorado	44,560	44,000	44,320
Eastern	63,000	65,400	61,800
Florida	1,000	1,000	1,050
Illinois	171,200	200,000	175,800
Indiana	17,700	18,000	18,200
Kansas	298,050	309,000	298,900
Kentucky	25,800	27,000	25,600
Louisiana	441,550	445,000	440,950
North Louisiana	108,950	.....	108,350
South Louisiana	332,600	.....	332,600
Michigan	43,385	45,000	51,165
Mississippi	100,405	99,000	103,405
Montana	25,180	24,000	25,000
Nebraska	550	600	600
New Mexico	117,350	110,000	117,350
Oklahoma	399,200	405,000	399,050
Texas	2,333,755	2,290,000	2,333,755
Dist. 1 (Southwest)	24,275	.....	24,275
Dist. 2 (Southwest)	160,675	.....	160,675
Dist. 4 (Southwest)	247,600	.....	247,600
Dist. 3 (Gulf Coast)	499,875	.....	499,875
Dist. 5 (Eastern)	40,875	.....	40,875
Dist. 6 (Eastern)	118,605	.....	118,605
East Texas Field	308,000	.....	308,000
Dist. 7-C (West)	41,260	.....	41,260
Dist. 8 (West)	637,650	.....	637,650
Dist. 7-B (W. Central)	40,975	.....	40,975
Dist. 9 (N. Central)	127,725	.....	127,725
Dist. 10 (Panhandle)	86,240	.....	86,240
Wyoming	121,290	124,000	120,790
Total United States	*5,209,025	5,220,000	5,226,085
Change fr. prev. wk., dn.	17,060		

Total production January 1-September 20 †1,314,188,275 bbl.
Same period last year (crude plus cond.) 1,247,106,120 bbl.

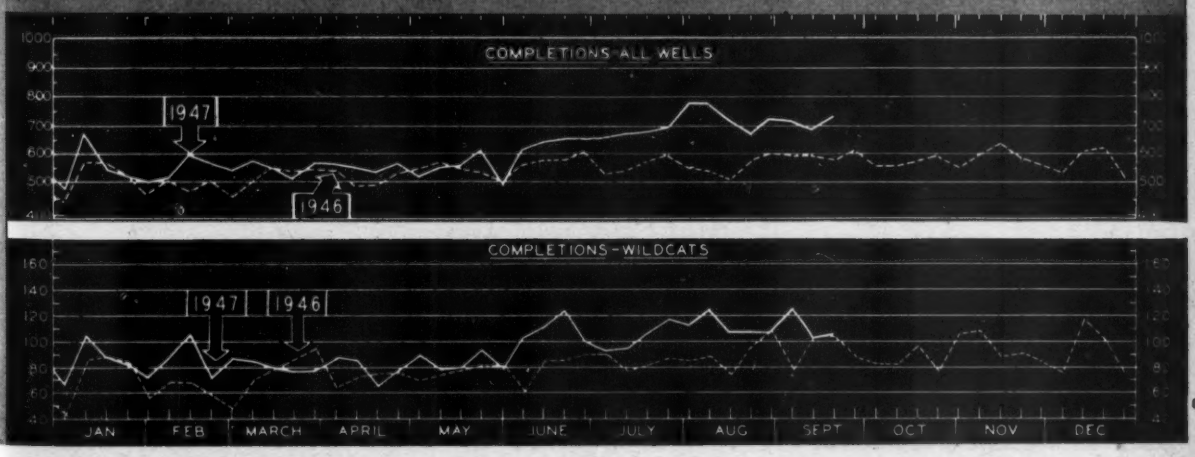
*Not incl. 41,910 bbl. condensate. †Incl. 8,322,610 bbl. condensate.

OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS

Solid line charts weekly completions, service wells in Eastern area included.



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MARKETS

NATURAL gasoline continued extremely strong, residual fuel oil showed additional signs of softness, while other products were generally unchanged in Mid-Continent petroleum markets this week.

Sales officials were unanimous in emphasizing that the weakness in heavy fuel oil is temporary and that demand will pick up as soon as colder weather begins drawing on consumer storage with increased consumption and interruption of industrial natural-gas supplies in the East.

In the meantime, No. 6 was reported moving at $2 per barrel, Group 3, with some material available for $1.90. This contrasts with prices ranging up to $2.45 a few months ago.

Heavy Demand for Natural

One buyer in the products market in the Mid-Continent area commented this week that natural gasoline is becoming one of the best possible "trading stocks" in today's tight products market. Quotations remained steady at 6⅜ cents Group 3, and 5⅞ cents North Texas, with no spot material available. "We could get 7 cents for our natural today if we wanted to take advantage of the situation," he added.

Approach of the winter gasoline season, with its heavier requirements for volatility in blending motor fuel, was increasing demand for natural gasoline. Competition for these light fractions from other users, such as L.P.G., also added to demand. One major manufacturer and marketer was allocating the product according to customer requirements.

Calls for light heating oils continued heavy. Little if any spot-market material was reported. Motor fuel in the Mid-Continent area was still tight, and one North Texas shipment of 50 cars was reported to have been offered at 9¼ cents on a Group 3 basis.

One marketer said the heavy demand for distillate heating oils had resulted in the appearance on the market of some inferior grades of No. 2 fuel oil. Kerosine was moving on the spot market at about ½ cent above the contract market level of 7¼ to 7½ for 42-44.

Though some slackening of motor-fuel demand was anticipated with the end of the summer driving season, farm demand for gasoline for fall planting was reported to be contributing to the strength of this market.

Although the heavy-fuel-oil market in the interior was showing temporary weakness, one supplier was reported to have received inquiries for this material from New England, requesting quotations for delivery during the winter months.

East Coast Market

In the East, the products price situation was described as confused. Several more companies fell in line behind The Texas Co. in reducing prices on gasoline and fuel oil. In New York, considerable "jobber unrest" was reported; some independent suppliers purchasing at the high prices prevailing in the open Gulf Coast market said they would be forced to quit selling if competition forced them to roll back prices.

On the Gulf Coast, demand for light distillate heating oils was still exerting heavy pressure on suppliers. No. 6 failed to show the weakness exhibited in the Mid-Continent area, and prices appeared firm at about $2.50 per barrel. Among lubricating oils, 2,000 No. 5-6 neutral was reported in short supply, and one marketer said he had been unable to cover export orders.

Representative Quotations

Representative spot-market quotations of leading suppliers as of September 22, 1947. Figures are f.o.b. plant for tank-car shipment in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor	Texas Gulf Coast
Regular gasoline, 73-75 octane	8¾-9½	10.5-10.9* 9.3-9.10†	9-10½
Premium gasoline, 78-80 octane	9½-11¼	10.2-12	9½-11½
42-44 w.w. kerosine	7½-8	7.8-8.3	7½-8
No. 2 straw fuel oil	6⅞-7⅛	6.8-7.2	7¾
No. 6 residual	$1.95-2.15	$2.22-2.52	$2.00-2.52

*Branded (74-76 octane); †Unbranded (74-76 octane).

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	6⅜	5⅞	6⅛
Grade 18-55	7.65	7.05	7.35

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	11-12¼
750 vis., No. 3-4 neutral	13-14½
2,000 No. 5-6 neutral	14½-16

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 p.p.	29
200 vis. No. 3 neutral, 0-10 p.p.	18-19

Western Pennsylvania

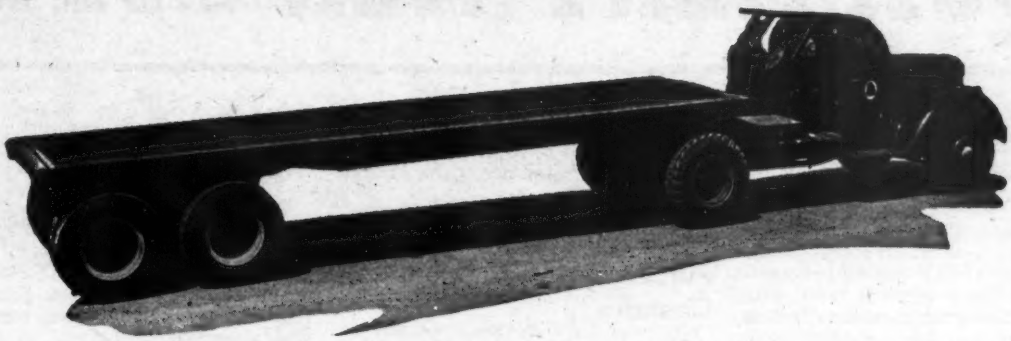
145-155 vis. 10 p.t. bright stock	45
180 vis. p.t. neutral	43

CRUDE-SCALE WAX

Mid-Continent

130-132 A.S.T.M. melting point	6¾-7¾

HERE'S AN OIL FIELD TRAILER WITH *STAMINA!*



This serviceable American-built tandem platform trailer was developed by our engineering staff with the cooperation of hauling contractors and producers throughout the industry. It's sturdily-built to meet the most rugged hauling tests . . . designed and constructed from the standpoints of endurance, versatility and economical operation. The model S-F 42-T shown above is only one of a *complete line* of oil field platform and pole trailers—both single axle and tandem models in lengths to suit your needs. Prompt delivery assured. Write us TODAY for complete information—no obligation, of course.

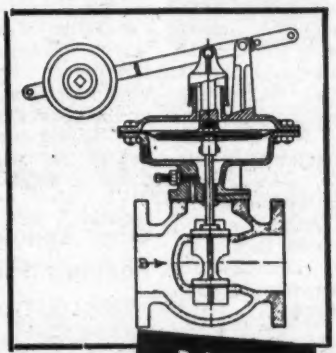
AMERICAN BODY and TRAILER INC.

NORTH LITTLE, ROCK ARK. 3131 EAST BROADWAY
MAIN OFFICE - OKLAHOMA CITY 1500 EXCHANGE AVENUE
AMARILLO, TEXAS 740 NORTH GRAND

Sensitive AUTOMATIC CONTROL

OF

VACUUM OR BACK PRESSURE ON WELLS, GATHERING LINES OR SEPARATORS



- *Utmost sensitivity* is assured by large diaphragm area, and constant loading throughout inner valve travel.
- *There is no packing box,* since the diaphragm chamber is close-coupled to the body.
- *Shifting the lever position* changes the valve from a vacuum regulator to a back pressure valve.
- *Rain cap* protects diaphragm on out-of-door installations.
- *Sensitive, efficient, economical, trouble-free* service is assured by these features and by the many others described in bulletin G-1. Send for a copy today!

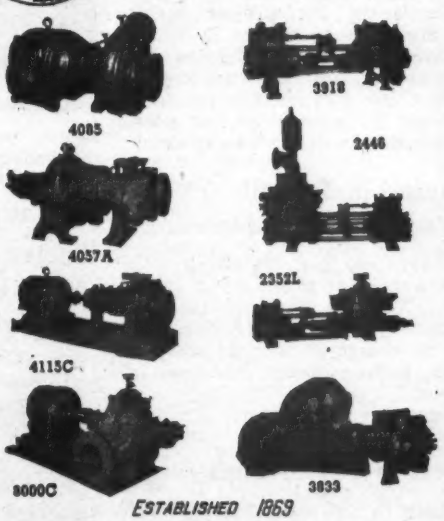
DAVIS REGULATOR COMPANY

Distributor: **Westcott & Greis, Inc., Tulsa and Houston**

PUMPS

CENTRIFUGAL
RECIPROCATING

BUILDERS OF OUTSTANDING PUMPS
Since 1869



ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

323 W TENTH ST.

EQUIPMENT MEN ... in the News

C. P. Parsons Announces New Organization

Backed with the long experience of C. P. Parsons, H. F. (Blackie) Clark, Turner Briggs, Bernie Thompson and others in the field of oil-well cementing and related services, and with adequate financing, Spartan Tool & Service Co. has been formed with headquarters in Houston.

Offices are on the twenty-first floor of the Esperson Building and a service and shop building is located on Old Spanish Trail near Arrowhead Park.

Initial plans call for a $3,000,000 program of cementing equipment, bulk cement equipment, squeeze tools, open-hole testing, and related tools and services.

Spartan is starting business immediately with the Spartan Perfo-Tester, a combination casing perforator and casing tester which Clark has been developing and operating during the past 2 years. With this device, casing is perforated at the desired level and a test is immediately made of the productivity of the formation. In cases where a previous set of perforations has been squeezed and before another set is shot, the Perfo-Tester can make a dry test on the results of the previous squeeze job. The Perfo-Tester is then immediately ready to again perforate the casing and to make a productivity test of the formation. Perfo-Tester crews have already been trained by Clark and are ready to operate for Spartan.

Parsons will head the new organization, Clark will manage the field operations, Briggs will handle sales, and Thompson will handle exports.

Geis and McDowell Elected Vice Presidents

Carl Geis and T. E. McDowell have been elected vice president of Pyle-National Co., Chicago, with the former placed in charge of sales and the latter in charge of engineering. W. A. Ross, sales manager, continues in that post.

Two New Salesmen Added to Taylor Staff

William D. DeCourcy has reported to the Pittsburgh office of Taylor Instrument Companies to take over his duties as industrial sales representative. He will cover the western counties of Pennsylvania with the exception of Allegheny County, as well as part of West Virginia. Harold M. Messenger will cover part of North and South Carolina out of the Atlanta office.

Ideco Announces Purchasing Department Changes

W. L. Reynolds has been appointed manager, purchasing and stock control, supply stores division of International Derrick & Equipment Co. in Dallas. Reynolds has been with Ideco since 1941 and was formerly purchasing agent of the supply-stores division. Albert Ditson has been appointed purchasing agent, supply-stores division at Dallas. He was formerly with Petroleum Administration for War in Washington in the foreign materials section. Ernest H. Polliet has been appointed purchasing agent at Marietta, Ohio. H. A. Gross has been appointed purchasing agent at Columbus.

Ashbaucher Succeeds Eggers

ASHBAUCHER

B. M. Ashbaucher has been appointed manager, Mid-Continent oil-field rope sales, for American Steel & Wire Co., Cleveland. In his new position, with headquarters in Dallas, he will succeed Edwin T. Eggers, who has been transferred to the general sales department of the company in Cleveland.

Four Wheel Drive Elects Officers

At the annual stockholders' meeting of Four Wheel Drive Auto Co., all members of the board of directors were reelected. Walter A. Olen was reelected president for the thirty-eighth time at the organization meeting of the board of directors immediately following the stockholders' meeting. Other officers of the company elected were: Joseph D. Cotton, vice president; R. H. Schmidt, vice president in charge of sales; Robert A. Olen, general manager; S. H. Sanford, secretary; Helen Weller, assistant secretary; J. A. Driessen, treasurer; and G. F. Richardson, assistant treasurer.

Ford Introduces 1948 Trucks to Managers

District truck and fleet managers from the 33 districts of Ford Motor Co. were given their first view of the new 1948 line of Ford trucks at a recent meeting in Dearborn. Ford's six regional truck and fleet managers also attended.

At sessions in the Dearborn Inn and at the nearby Ford engineering test track, the truck and fleet managers were addressed by J. R. Davis, vice president in charge of sales and advertising; W. A. Williams, general sales manager; J. D. Ball, director, and D. W. Lee, assistant director of the truck and fleet sales department; W. E. Kimbrough, supervisor of the truck sales section; and S. M. Copland, supervisor of the fleet sales section.

Kellex Appoints Research Director

H. Hugh Willis, nationally known specialist in electronics, has been appointed director of research and development of Kellex Corp., atomic-energy subsidiary of M. W. Kellog Co. Willis was formerly chief research director and vice president for Sperry Gyroscope Co., Inc., and vice president for engineering and product development of Eversharp, Inc. During the war he was a member of the radar section of the National Defense Research Committee.

Gow Appointed Packing Sales Manager

David E. Gow has been appointed packing sales manager of Asbestos Products Division, Raybestos-Manhattan, Inc., with headquarters in Manheim, Pa. Gow was formerly branch manager of the Cleveland office of asbestos textile and packing division of the corporation. He succeeds Jack E. Cole who has been transferred to Chicago to take up the duties of Chicago branch manager of the equipment sales division.

Wise Tulsa Representative

Banner Iron Works, St. Louis, manufacturers of Meehanite castings, has appointed Max R. Wise, Tulsa, as its sales agent. Wise also represents St. Louis Castings Co., General Metal Products Co., and Arrow Parts Forging Co.

Grissom to Represent Unibolt in Oklahoma

Thornhill-Craver Co., Houston, manufacturers of Unibolt products, announces the transfer of Earl Grissom to Oklahoma. Grissom, who is widely known throughout the Gulf Coast and particularly in the South Texas area, has been the Unibolt sales representative with headquarters at Corpus Christi for the past several years. In Oklahoma he will make his home and headquarters at Purcell and will represent his company in the Mid-Continent area.

Brown Adds to Branch Staffs

New sales and service engineering staff additions and promotions have been announced by the Brown Instrument division of Minneapolis-Honeywell Regulator Co.

Edward B. Kohl has been transferred to Corpus Christi, Tex. He was formerly with the Houston branch office of the company.

I. K. Farley has been transferred from the Philadelphia branch office to Houston.

John D. Root, formerly instructor at the Brown School of Instrumentation, has been made sales engineer at Philadelphia.

E. Curt Richards has been transferred from the company's general sales department to the New York sales engineering staff.

Thomas Pitts has been appointed industrial sales engineer at the Charlotte branch office.

In line with the company's expansion of customer service facilities, it has added the following men to its branch office field service engineering staffs: William E. Brittain, Philadelphia; Edward J. Chance, New York; Ethron B. Deebel, Philadelphia; Gerald R. Dryden, Syracuse; John W. Forbes, Albany; Carl R. Haug, Philadelphia; Willard A. Holm, New York; Roger F. Lederer, Chicago; Albert J. Leonaitis, Hartford; Elgin H. Lochte, Houston; John E. Luttrell, Buffalo; Kenneth Shapleigh, Boston; Clayton K. Taylor, Indianapolis; Robert H. Walker, Cleveland; and Frank M. West, Boston.

Pollard Heads Advertising Department

Braxton Pollard, formerly advertising manager of A. P. Green Fire Brick Co., has been transferred to Bigelow-Liptak Corp. as advertising and sales-promotion manager. Pollard will work very closely with Bigelow-Liptak's sales manager, E. B. Wolf, in the preparation of trade-paper advertising, direct-mail, catalogs, bulletons, etc.

Appoint Tatkin Ad Manager Of Vapor Recovery

Albert Tatkin has been appointed advertising manager of Vapor Recovery Systems Co., Compton, Calif. Tatkin will be in charge of the company's advertising and and will assist in sales engineering.

Tatkin is a graduate petroleum engineer from University of Minnesota. For the past year and a half, he has been employed as an account executive at McCarty Co. During the war, he served as a captain in the Air Corps. Prior to his Army service, he was associated with Western Geophysical Co.

J. Ball, parts manager, and V. C. Genn, general sales manager, inspect Detroit Diesel Engine Division's new mobile service unit, which is equipped with the necessary tools and parts to perform any type field-repair work on diesel engines. C. R. Leslie will operate the unit during performance tests

Moffatt of U. S. Steel Retires, Succeeded by Schreiner

C. R. MOFFATT

Charles R. Moffatt, director of advertising of United States Steel Corp. of Delaware, will retire September 30 after 40 years of continuous service with the corporation. Moffatt was named advertising manager of Illinois Steel Co. in 1919. When that company consolidated with Carnegie Steel in 1935, he became advertising manager of the new Carnegie-Illinois Steel Corp. Three years later, he was appointed the first director of advertising of United States Steel Corp. of Delaware, continuing in that capacity until the present time.

G. Reed Schreiner has been appointed director of advertising to succeed Moffatt. Schreiner graduated from University of Pittsburgh in 1916 with a B.A. degree. He began 28 years of service in advertising departments of U. S. Steel subsidiaries when he was employed by Carnegie Steel Co. in 1919. He was made assistant advertising manager of Carnegie-Illinois Steel Corp. in 1936 and was promoted to advertising manager 2 years later. In 1947 he became assistant director of advertising of the Delaware corporation, the position he held at the time of his present appointment.

U. S. Rubber Announces Sales Changes

H. Barden Allison has been appointed sales manager of the Gilmer division of United States Rubber Co., V-belt manufacturing and distributing unit in Philadelphia. Allison will be succeeded at Cincinnati by Ralph W. Stambaugh, a salesman in that district. Other personnel changes in the company's mechanical goods sales organization include: Purdy Miller, district sales manager in Buffalo, appointed district sales manager in Indianapolis; N. W. Swenson succeeds Miller at Buffalo; Paul S. Bigby, assistant district sales manager at Detroit, named district sales manager at Milwaukee.

New Corporation Formed

Cabl-Ox Corp., 6 North Michigan Avenue, Chicago, announces the purchase of the exclusive rights to the Cabl-Ox wire-rope clamp, Cabl-vise, and allied wire-rope products. J. O. Straub, executive vice president of the new firm, announces that all wire-rope products will be manufactured and merchandised on a much enlarged and accelerated plan.

Classified Advertising

The Market Place for the Oil Industry

EQUIPMENT FOR SALE

FOR CABLE TOOLS
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

FOR SALE: 150,000 board feet of used road lumber located in Thornwell Pool Section 25-11-5w, Jefferson Davis Parish, Louisiana. Please contact O. C. Brown, Cities Service Oil Company, Gladewater, Texas.

WELL DRILLING equipment. Spudders, Beams, Core drills, light Rotaries, used equipment fully reconditioned. Also tools, cable, casing. Almost everything for well drilling. Pressey & Son, Pueblo, Colorado.

SUBSTRUCTURES: Parkersburg, Ideco, American, L. C. Moore, Independent E.L.A. 7'x24'—550.00 each. Oklahoma Pipe & Supply, Box 4671, Telephone 62-1644, Oklahoma City, Okla.

FOR SALE: 1200 feet good 2⅞ inch pipe $1.35 per foot F.O.B. Ft. Worth, Texas. Drawer 1600, Fort Worth, Texas.

FOR SALE: 60 H.P. 6 cylinder gasoline power units, fully enclosed with electric starter and generator, clutch and transmission, direct connected to single drum high speed hoist. Will sell separately. 1 ton capacity jib crane suitable for shop. P. O. Box 4313, Memphis, Tenn.

3300 FT. 3½ in. new drill stem; Reed tool joints; $3.25 per ft. f.o.b. Clay City, Ill. Lot only. 10,000 ft. 6⅝-in. used 11 lb. lap weld well casing; shopped; $1.20. 2000 ft. used 7 in. 20 lb. well casing; shopped; $1.60; f.o.b. Wichita, Kansas. Leland Waggoner, 1200 W. University, Urbana, Illinois.

STORAGE TANKS FOR SALE

Three 80,000 bbl. riveted storage tanks with steel roofs and structures, in excellent condition, now being dismantled. Diameter 117'-2"; height 41'-10"

Also have new 10,000 bbl. cone deck bolted steel tanks.

Phone: TRinity 2091

R. H. TECKLENBORG CO.
811 West 7th St.
Los Angeles 14, California
Cable address: RAYTECK

EQUIPMENT FOR SALE

FOR SALE: Model 55 Wichita Spudder less mast with PA-100 International engine in good condition. Located close to Pampa, Texas. Nabob Oil & Gas Company, Box 448, Amarillo, Texas.

SMALL SPUDDER with 36 foot steel mast, stems, bits, bailers, sockets, water tank. All new hand tools, wrenches and tool box with 2½ Ton 6x6 GMC truck, $4500.00. C. L. Miles, 1117 Baker St., Great Bend, Kansas.

SALE MOTORS

New Chrysler 8 cylinder industrial type engines. Crated with spare parts. 20 available. Gasoline.

AIR COMPRESSOR RENTAL COMPANY
19615 Nottingham Road
Cleveland, 10, Ohio

FOR SALE

20—2,000 Gal. Gasoline Tanks, with Pumps and Motors mounted on semi-trailers. 20—New A.P.I. High 500 bbl. Bolted Steel Tanks. 10—New A.P.I. Low 500 bbl. Bolted Steel Tanks. 10—1,000 bbl. new A.P.I. Bolted Steel Tanks. 2—10,000 bbl. New A.P.I. Bolted Steel Tanks. Also new Welded Steel Tanks. Also used Oil, Grain and Water Tanks in all sizes.

INDEPENDENT TANK MFG. CO.
Seminole, Okla. Box 102. Phone 977

DRILL PIPE

11,500' NEW 3½" O.D. 13.30# Range 2, Grade A, API Internal Upset Seamless Drill Pipe with 4¾"x18" long, 2 11/16" Bore, Hinderliter Counterbore Tool Joints—Located Odessa, Texas. Price, F.O.B., Odessa, Texas ..... $2.25/ft.

7000' USED 3½" O.D. 13.30#, Range 2, Grade D, Regular API Seamless Drill Pipe with Hinderliter Regular API Tool Joints—Joints 4⅛" (NEW 4¼"). Price, F.O.B., Seminole, Oklahoma .. $1.35/ft.

5000' USED 3½" O.D., 13.30# Range 2, Grade D, Internal Flush. External Upset Seamless Steel Drill Pipe with Hughes Full Hole Tool Joints, modified, (Joints 4¼"). Price, F.O.B. Duncan, Oklahoma ..... $1.50/ft.

H. A. McCARTHY
310 Thompson Bldg. Phone 5-3296
Tulsa, Oklahoma

352 NEW API BOLTED STEEL TANKS IN STOCK

All Boxed for Export Stored at N. Y.—New Orleans—Los Angeles
60—1000 Bbl. Cap. Low Type—292—100 Bbl. Cap. Standard

L. M. STANHOPE, ROSEMONT, PENNA.

25—35,000 bbl. wood-roof tanks. Will cut down match mark load shell and bottom on cars Martinsville, Ill. Weight including angles & steel ladder approx. 103 tons each. Plates 5'x10' riveted, shell and bottom good condition. Price each $7500.00

2—10,000 bbl. new bolted tanks complete with bolts, gaskets, etc. net weight 72,040 lbs. located Bynum, Ala. Price each $7000.00

5½" O.D. 14 lb. seamless casing 2⅞" O.D. tubing, All New

INTERNATIONAL TRADING SYNDICATE
P.O. Box 1858 Tulsa, Okla. Phone: 3-6141

EQUIPMENT FOR SALE

FOR SALE: One 7¾ x 18 Model 15,000 Whelan-Lucey Power Slush Pump as good as new. Melton Supply Co., Box 1360, Seminole, Okla.

1—1½ Ton Dodge, 1—½ Ton Pickup, 2 HS Cardwell Units, 1 Cardwell Mast. Tools and Lines. All in good condition, $6500.00. David Litan, Box 91, McPherson, Kansas.

FOR SALE: New Model 7000 Franks Rod and Tubing Pulling Unit, mounted on A-8 International Truck, complete with all tools. Will sell with or without truck. May be seen at Franks Mfg. Co., Tulsa, Oklahoma. Tri-State Contracting Co., 501 Commerce Exchange Building, Oklahoma City. 7-4884 of 9-5079. L. L. Robinson.

FOR SALE

2—125 H.P. 350# Working Pressure "OIL WELL BOILERS," EXCELLENT condition. Completely reconditioned. Not used since last approval by State Boiler Inspector. Priced to sell.

POWEL BRISCOE, INC.
1916 First National Bldg.
Oklahoma City, Oklahoma

PUMPING UNITS FOR SALE

1—2-A-31C Lufkin Twin Crank Unit W/International engine, 3 well hookup W/American jacks, complete.

2—O.C.S., Goslin, 10 H.P., Twin Crank Units W/1 Waukesha and 1 Allis-Chalmers engine.

2—No. 14D Jensen, Twin Crank Units W/F & M 346 engine, 2 well hookup W/American jacks, complete.

Western Pipe & Equipment Co.
922 Nell P. Anderson Bldg.,
Phone 2-5668, Fort Worth, Tex.

SHOT HOLE DRILLS

Large and Small

All are truck mounted, rotary, chain pull down, smallest pump size 4 x 6. Some are in excellent condition; others need repair. Price F.O.B. Dallas, from $3,000 to $8,000, including truck.

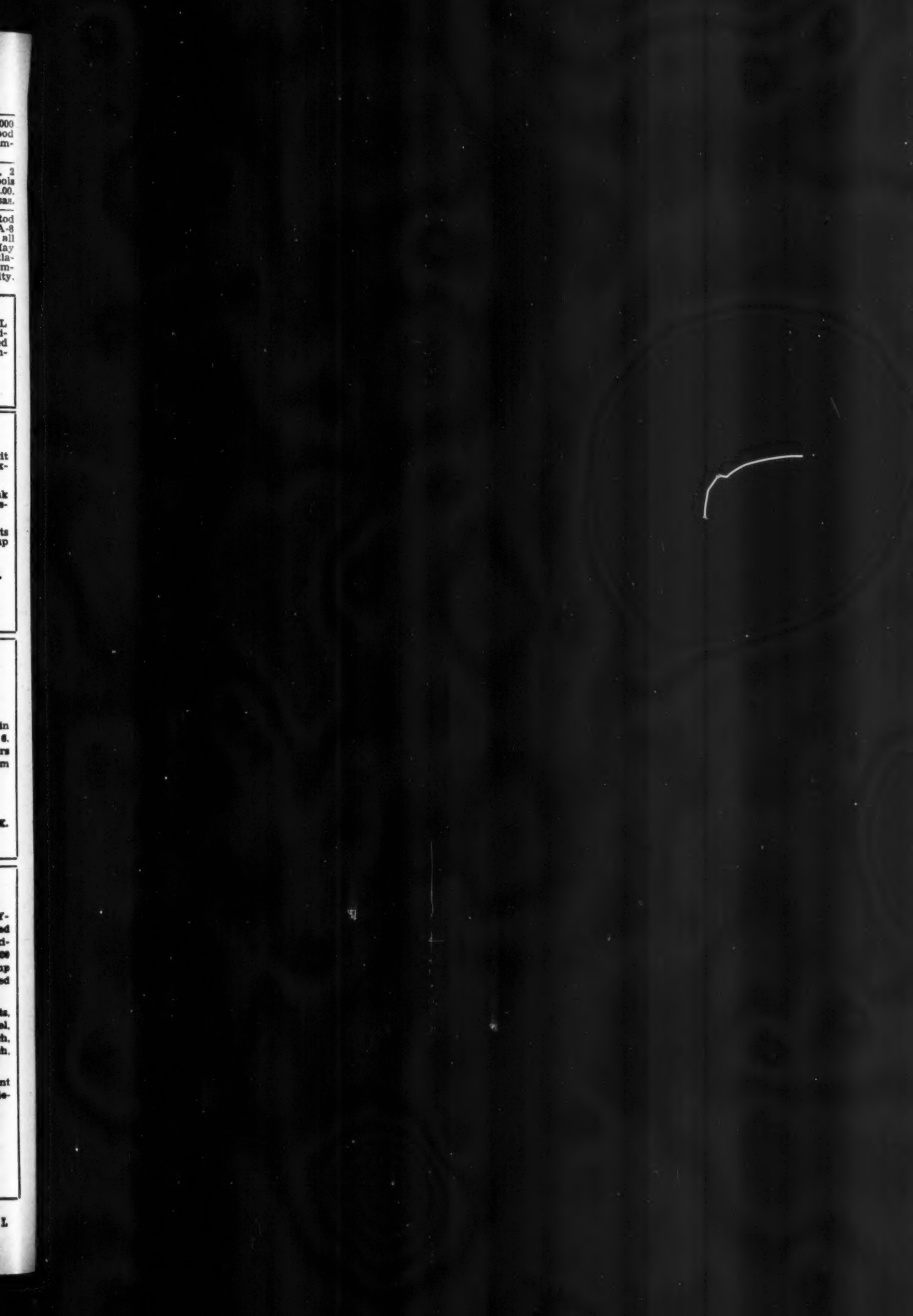
For details write

8800 LEMMON AVENUE, DALLAS, TEX.

HYDRAULIC PUMPS

Aldrich Pump Co. Vertical Triplex HYDRAULIC PUMPS, 2¾" x 8", equipped with Herringbone gears, 67.5 GPM. Maximum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate.

Motors are 75 HP, 3/60/220-440 volts, 1740 RPM. Complete with starting panel, consisting of G.E. motor starter switch, push button control, square "D" Switch, and capacitator.

Purchased new 3½ years ago. Excellent condition. Available for immediate delivery.

CONSOLIDATED PRODUCTS CO., INC.
17-99 Park Row, New York, N. Y.